

2023 AMSSM Oral Research Poster Presentations

(*Clin J Sport Med* 2023;33:308–358)

TOPIC: Epidemiology

STUDY: Other

Snowboarding Versus Surfing-Related Injuries in the United States Emergency Departments 2012-2021

Primary Author/Presenter: Petra Abou lhosn, MD

Nick Thornton, MD, Anusha Lekshminarayanan, MD, and Shane M. Drakes, MBBS

Affiliation: NYMC/Metropolitan, New York City, New York.

Purpose: Board sports including snowboarding and surfing have gained immense popularity. Snowboarding and surfing are considered extreme sports. While one is dependent on land and snow, the other relies on water waves. Understanding the mechanisms for injury could provide insight for safety recommendations.

Methods: Data on 6098 snowboarding and 1847 surfing-related injuries contained within the National Electronic Injury Surveillance System over a 10-year period (January 2012-December 2021) were analyzed.

Results: On comparison of injuries sustained while snowboarding versus surfing, injuries were most common among the 11 to 20 age group for both (51.6% vs 28.8%), followed by 21 to 30 age group (30.2% vs 20.6%). Male injuries dominated in snowboarding and surfing (73.1% vs 73.7%). Caucasian participants sustained the most injuries (64.8% vs 50.7%). Injuries to the wrist (18.0%), head (17.8%), and shoulder (16.8%) were the most common in snowboarding. Injuries to the head (12.9%), face (12.2%) and foot (10.3%) were the most common in surfing. Fractures (34.7%) were the most common injuries in snowboarding, followed by strains/sprains (20.9%) and concussions and contusions (9.8%). While lacerations were the most common type of injury in surfing (26.5%) followed by strain/sprain (16.4%) and fracture (15.2%).

Conclusions: Injuries were common among young Caucasian males. Head injuries were commonly noted in either sport. Lacerations are the most common type of injury among surfers likely due to environmental hazards, sharp edges on the surfboard, reef, and lack of protective equipment. In contrast, fractures were the most common in snowboarding, likely because of the speed able to be achieved while riding combined with the terrain- hard snow, rocks, trees and ice.

Significance: Helmets, elbow, knee, and wrist pads may serve to protect snowboarders from fractures. Surfers may benefit from placing protective barriers on the sharp edges of their surfboard such as the nose and fins to prevent lacerations.

Acknowledgments: Thank You Dr Drake and Dr Lekshminarayanan for your support of metropolitan residents with sports medicine interest

TOPIC: Pediatrics

STUDY: Cohort

Concussion Trends in Pediatric Sports Medicine During the COVID-19 Pandemic in Florida

Primary Author/Presenter: John Anderson, DO

Sarah Irani, MD, Lauren Irwin Harper, PhD, Danielle Ransom, PsyD, and P. Patrick Mularoni, MD

Affiliation: Johns Hopkins All Children's Hospital, St. Petersburg, Florida.

Purpose: Florida allowed for return to sport in both high school and recreational leagues earlier than most of the United States after COVID lockdowns. This study aims to evaluate trends in concussion in the year preceding and during the COVID-19 pandemic.

Methods: Demographic characteristics were extracted as part of a retrospective chart review of youth ($M = 15.74$, $SD = 1.91$) diagnosed with concussion in a sports medicine specialty clinic. Subjects were included if concussion was diagnosed within one of 2 date ranges: (1) March 15, 2019 to March 15, 2020 (Pre-COVID-19 Pandemic cohort) or (2) March 16, 2020 to March 16, 2021 (COVID-19 Pandemic cohort).

Results: Fewer patients presented with concussion in the Pandemic cohort ($n = 244$) compared with the Pre-Pandemic cohort ($n = 419$). Results of χ^2 analyses did not demonstrate statistically significant group differences in sex, type of insurance, and injury mechanism (all P values were greater than 0.05). Analyses exploring race/ethnicity indicated significant differences between cohorts, with significantly more subjects opting not to report race/ethnicity in the Pandemic Cohort in comparison to the Pre-Pandemic cohort. Additionally, results of t -tests comparing group differences in age, time from injury to clinic presentation, and time to recovery revealed no significant differences between the groups (all P values were greater than 0.05).

Conclusions: Although fewer patients presented with concussion during the first year of the COVID-19 pandemic in comparison to the previous 12 months, we did not observe statistically significant differences in demographic characteristics of those patients presenting for evaluation. Furthermore, there was no measurable variation in time to clinic presentation and time to recovery, despite the lockdown, when compared to prior to the pandemic.

Significance: Findings are not consistent with reported pediatric pandemic-related trends in disparate access to care based upon demographics. Further work is needed to understand the role of social determinants in concussion care access and recovery.

Acknowledgments: Research funding support was provided by the Kart for Kids Concussion Initiative. Research assistant, Katelyn Heinz, ATC.

TOPIC: Other

STUDY: Survey

Diet Tracking App Use Not Associated With Disordered Eating Risk in Division I Athletes

Primary Author/Presenter: Sydney Asselstine, MD

Jill Kropa, MD and Jason Womack, MD

Affiliation: Rutgers RWJMS Sports Medicine Fellowship, New Brunswick, New Jersey.

Purpose: This pilot study aimed to determine if use of diet tracking apps by division I athletes was associated with screening positive for disordered eating compared to those not using them. Frequency and motivation for use were also examined for correlation with disordered eating as secondary endpoints.

Methods: Current division I athletes over 18 years old were invited to complete an anonymous electronic survey that assessed their use of diet tracking apps as well as the Brief Eating Disorder in Athletes Questionnaire (BEDA-Q), a validated screening tool for disordered eating. All participants received referral information for eating concerns. Statistical analysis was applied using Microsoft Excel.

Results: Seventy-two student athletes completed the survey; 55 females and 17 males, ages 18-23, ranging across 11 teams. Of these, 24 athletes (33.3%) acknowledged use of diet tracking apps in the past 6 months. Additionally, 34 athletes (47.2%) screened positive for disordered eating; 30 females, and 4 males represented from 9 teams. There were 13 of these positively screened athletes (38.2%) that used diet tracking apps, however this association was not significant ($P = 0.40$). Additionally, there was no significant correlation between frequency of app use and BEDA-Q score. There was a significant association between those that were currently dieting and using diet tracking apps (52.2% of 23 athletes, $X^2 5.4$, $P < 0.05$). Most common reasons for app use included to lose weight (50% of users), to ensure adequate caloric intake for energy expended, and to maintain weight; the majority of app users who screened positive for disordered eating were motivated to lose weight (69.2%).

Conclusions: Use of diet tracking apps, regardless of frequency, does not increase risk for disordered eating in division I athletes based on this preliminary data. Athletes currently dieting may be more likely to use these apps. Common motivators for use were to lose weight, to ensure adequate caloric intake, and to maintain weight. Athletes with disordered eating may be motivated to use these apps to lose weight.

Significance: Diet tracking apps can be utilized by athletes without increasing risk for disordered eating. Healthcare providers may opt to use these apps to assess or manage eating habits in athletes without contributing to disordered eating behaviors.

Acknowledgments: Thank you to the Rutgers University Athletic Department and Sports Medicine Department for their support of this project.

TOPIC: Musculoskeletal

STUDY: Survey

Needs Assessment of Common Injuries in Freestyle Soccer

Primary Author/Presenter: Peter Azzam, MD

Andrew Nobe, MD

Affiliation: UCI Family Medicine Residency, Irvine, California.

Purpose: To identify common injuries among freestyle soccer athletes and initiate serve as a precursor to further research in this sport.

Methods: A 10-question survey was designed and sent to freestyle soccer athletes via email, text message, and social media.

Results: The most common injury reported by the 45 survey respondents was hip/groin injury (about 21), followed by knee injury (About 11), spine (neck and lower back; about 7), ankle (about 6), and loss of muscle memory impeding sport performance (3). The last condition was described by a few athletes and involved the sudden regression of muscle memory and an inability to continue juggling the soccer ball; this condition always involved one ankle and significantly limited performance. The vast majority of injuries described were chronic overuse injuries.

Conclusions: Among survey participants, the most common freestyle soccer injuries were hip/groin injuries, followed by knee injuries, neck/back injuries, ankle injuries, and a syndrome involving regression of muscle memory. The vast majority of these were chronic overuse injuries as opposed to acute injuries.

Significance: This initial needs assessment provides a basis for common injuries in freestyle soccer, which can serve as a springboard for further research in this sport.

Acknowledgments: UCI Family Medicine Residency and Sports Medicine Track Andrew Nobe, MD, director of UCI Sports Medicine Track Christopher Kroner, MD, and Brian Kim, MD, sports medicine faculty at UCI Health and close mentors of mine UCI Family Medicine Faculty.

TOPIC: Running

STUDY: Survey

Runner Health Promotion and Injury Prevention: Current Practices and Interest of Recreational Runners

Primary Author/Presenter: Dylan Bennett, MD

Brett Toresdahl, MD, Mark Fontana, PhD, Joseph Janosky, DrPHc, MSc, PT, ATC, and Elizabeth Fierro, DO

Affiliation: Hospital for Special Surgery, New York, New York.

Purpose: The purpose of this study was to measure the interest of runners in health promotion, as well as to understand runners' current injury prevention strategies and sources of information.

Methods: An electronic survey was distributed by email to runners who recently participated in running medicine research studies. Inclusion criteria included age 18+, participation in 1+ road race in the past year, or plan to participate in 1+ race in the upcoming year.

Results: A total of 238 runners participated, mean age 46.5 (standard deviation [SD] 23.8), 49% women, with 43% having experienced an injury in the past year. Staying injury free was rated as very important by 198/231 (86%), whereas achieving a goal finishing time was rated very important by 38/238 (16%). Most runners (181/230, 79%) are willing to invest 90 min/wk in rehab-type exercises for an absolute risk reduction (ARR) for injury of 5%. A third of runners (69/

213, 32%) are willing to modify their training and accept a slower race finishing time (15 minutes slower for marathon, 7.5 minutes for half) for an ARR of 5%. Current injury prevention strategies used by runners include the following: rehab-type exercises/strength training (119/228, 52%), specific shoes/orthotics (91, 40%), and supplements (82, 36%). The most common sources of injury prevention information used by runners are the internet (167/231, 72%), physical therapists (102, 44%), and friends (93, 40%).

Conclusions: Health promotion and injury prevention is very important to runners, and they are willing to invest significant time in exchange for a modest decrease in injury risk. While most runners do not rate race performance as very important, fewer runners are willing to prevent injury by modifying their training if it has a negative impact on their race performance.

Significance: Given the high rate of injuries experienced by runners, there is both a need for and an interest in health promotion/injury prevention programs. The results of this study will help guide the creation of future running injury prevention interventions.

TOPIC: Education

STUDY: Survey

Educating Trainees on Pre-Participation Physicals of the Special Olympics Athletes—An Evaluation

Primary Author/Presenter: Greta Bires, MD

Allison Casola, PhD, MPH, MCHES, Caitlyn Haines, MD, Jeremy Close, MD, MPH, and Mary Stephens, MD, MPH

Affiliation: Thomas Jefferson University Hospital.

Purpose: Patients with intellectual and developmental disabilities (IDD) experience several obstacles accessing quality health care, compounded by lower physical activity levels. Increasing provider knowledge including dedicated training on considerations for physical activity participation is key.

Methods: Students participated in a round robin case-based discussion to introduce and familiarize them with the pre-participation evaluation including special considerations for those with IDD. Participants were invited to complete a brief, mixed-methods, post-event feedback survey. Data were exported from Qualtrics into Excel for cleaning and analysis.

Results: Twenty medical students and 5 faculty participated with 15 completing the post-evaluation survey (70%). Seven (46.67%) were very satisfied and 8 (53.55%) were satisfied with the event with 15 (100%) want to attend future workshops. Participants reported that working through the cases with discussions and hearing firsthand experiences from the facilitators was the most enjoyable aspect of the event. The participants were surprised by many things including that “patients with epilepsy can be cleared to swim,” “the level of clearance you can comfortably give to even patients with some complicated medical history,” and how many sports (especial power lifting) are available through the Special Olympics. They also expressed interest in learning more about “common physical comorbidities to look for in those with IDD,” “common adaptive equipment for those with IDD” and “how medical students can best support those with IDD.”

Conclusions: We created an event that increased medical students’ interest in the care of those with intellectual and developmental disabilities. All students were satisfied with the event and expressed interest in learning more on this and other related topics. The high likelihood they would attend another event highlights a potential opportunity to create or develop additional courses, workshops, or electives that expand on care of patients with IDD.

Significance: This novel event introduced trainees to caring for patients with IDD; a prominent gap in current medical education and training. There is potential to replicate this event at medical schools around the country to reach more students.

Acknowledgments: We would like to acknowledge the Special Olympics for their support with this event.

TOPIC: Other

STUDY: Survey

A Multi-Institutional Cross-Sectional Survey of Nutrition Knowledge in NCAA Division I Athletes

Primary Author/Presenter: Alexandra Bray, MD

Sydney Burger, BS and Brian Young Kim, MD, MS

Affiliation: OHSU Hillsboro Family Medicine Residency, Portland, Oregon.

Purpose: To better understand current trends in collegiate athlete nutrition knowledge (NK) across multiple institutions and sports, through subgroup analyses of responses to the Abridged Nutrition for Sport Knowledge Questionnaire (A-NSKQ).

Methods: Collegiate athletes completed a survey consisting of demographic questions and the validated Abridged Nutrition for Sport Knowledge Questionnaire (A-NSKQ). Leanness versus non-leanness sport designation was determined using the classification from Torstveit and Sundgot-Borgen (2005). Total and subgroup analyses were performed using *t*-test and ANOVA.

Results: One hundred eighty-nine athletes from 3 NCAA division I institutions completed the survey (66.5% completion rate, 64.6% female, 18 sports represented). Mean A-NSKQ score was 15.4 ± 4.3 (max possible score 35). There was no significant difference in A-NSKQ scores between genders (females 15.7 ± 4.3 , males 14.8 ± 4.2 , $P = 0.2$). There was no significant difference in A-NSKQ scores between athletes in leanness versus non-leanness sports (15.7 vs 15.1 , $P = 0.4$). Prior to completing the A-NSKQ, 36.5% of participants rated their NK as good or excellent. After completing the A-NSKQ, 13.2% rated their NK as good or excellent. There was a significant difference between A-NSKQ scores in individuals who had prior nutrition education versus those who did not (16 vs 14.6 , $P = 0.02$). A site effect was observed, with a mean difference of 3 points separating the highest- and lowest-scoring sites ($P < 0.001$).

Conclusions: Mean A-NSKQ scores in this population were similar to those previously reported. Both male and female athletes demonstrated poor NK. Completing the A-NSKQ seems to have changed athlete perception of their NK. There was no significant difference in NK between gender, or between leanness versus non-leanness sports. Athletes with prior nutrition education may have retained this knowledge, demonstrated by higher A-NSKQ scores.

Significance: Nutrition is an important component of athlete health. Notably, athletes with prior nutrition education had higher NK. Future research should focus on how to disseminate nutrition information to athletes in a meaningful and effective manner.

Acknowledgments: We thank the Medical Student Research Program at UC Irvine School of Medicine for their support.

TOPIC: Other

STUDY: Survey

ART (Assessment, Recognition, Treatment) Pilot to Identify Athletes at Risk for Mental Health Symptoms

Primary Author/Presenter: Jason Brayley, MD

Jennifer Salib, PsyD and Andy Ma, MD

Affiliation: Greater Sacramento Valley Family Medicine Residency Program, Sacramento, California.

Purpose: Ninety-day quality improvement pilot: (1) Identify patients at risk or experiencing mental health symptoms; facilitate timely connection to resources; routinely screen all new patients (2) Understand the demand for mental health services (3) Add to the scholarly literature.

Methods: When rooming the patient, MA read brief script introducing the mental health screening tool; patient completed form; physician reviewed; if score below threshold of concern encouraged patient try free digital therapeutic mindfulness app & reminded patient how to access mental health support. Elevated scores referred to psychologist for further evaluation with language that normalized & encouraged.

Results: One hundred four patients referred to psychologist for further evaluation; 4 declined services. One hundred (70 children & 30 adults) contacted; 88 (64 children & 24 adults) had single outreach consultation; 12 (6 children & 6 adults) received additional follow up care; 25 had history of previous mental health treatment. Soccer (17) & basketball (12) were the most common sports, followed by dance (7) & softball (6). Twenty-nine patients noted they were multisport athletes. Physicians surveyed about their comfort & experience; all reported some specialty training in behavioral health. Half reported discomfort screening for mental health needs without a tool; most somewhat comfortable screening with a tool; less than half reported comfort providing psychoeducation to athletes endorsing mild to moderate mental health concerns; most were comfortable suggesting digital therapeutic apps; all reported comfort referring to mental health services; most mentioned concern about availability of mental health services.

Conclusions: Acknowledging mental health as part of whole health is essential and an important message that sports medicine physicians can emphasize to athletes. Routinely screening for mental health symptoms can reinforce that mental health & physical health are inextricably linked. Continuing to destigmatize mental health and normalize athletes seeking help is crucial. Our quality improvement pilot identified a demand for & method to do this important work.

Significance: Prevalence of mental health concerns among athletes is substantial & similar to the general population, however athletes are less likely to seek help. More work must be done to shift this culture, and there is opportunity to include sports physicians.

TOPIC: COVID

STUDY: Cohort

How Compressed Sports Seasons in High School Athletics, Due to COVID, Impacted Injury Rate and Severity of Injuries

Primary Author/Presenter: Breanne Brown, DO, CAQSM, FAAFP

Eric Marchek, MPT, PT, CSCS

Affiliation: Providence St Joseph Health, Portland, Oregon.

Purpose: To evaluate the injury rate during a compressed sports season with COVID 19 compared to a normal sports season with preseason leading up to competition in high schools with employed ATCs. These findings can help with injury prevention in the future for student athletes.

Methods: Injuries and treatments provided are documented by the athletic trainers at the schools. With the use of Healthy Roster as an EMR, we can track injuries and treatments in this population. This data was used to compare injury rates from past sports seasons to the condensed season. These condensed seasons occurred following activity stoppage from March 2020 to March 2021 due to COVID-19.

Results: Data was gathered using Healthy Rosters as an EMR platform. Injury and treatment data was input and collected from 14 Providence school-based athletic trainers with schools that had condensed seasons. 1 concussions (compared to 24 in 12-week season) 17 dislocations (compared to 12 in 12-week season) A total of 1588 injuries were documented over a 7-week period beginning March 1, 2021. This represented 44% of all injuries in a normal 42-week school year. 16006 total treatments were recorded in the 7-week period. This represents 78% of all treatments in a normal school year 65 fractures (compared to 50 in 12-week season).

Conclusions: The rate, incidence and severity of injuries was increased with a compressed sports season. Factors contributing to this may be reduced activity during COVID restrictions, lack of pre-season conditioning and limited access to indoor facilities/regular training opportunities in the year prior to the condensed seasons. Most schools included in the data are public high schools who may lack resources a funds which may impact their fitness & wellbeing

Significance: Higher injury rate and a condensed sports season can lead to more athletes leaving sports which has significant impacts on future physical and mental wellbeing. Knowing this can help implement infrastructure to limit injuries and support athletes.

Acknowledgments: Tom Burton, Director of Operations Ortho/Neuro Institute; Joel Marick, Lead ATC Oregon region; Keith Eggleston, Lead athletic trainer, Spokane Region; Rebecca Valderrama, Senior Program Manager, System Orthopedic and Sports Medicine Institute.

TOPIC: Pediatrics

STUDY: Other

Recurrence Rate of Ganglion Cysts of the Wrist and Hand After US Guided Aspiration in Pediatric and Young Adult Athletes

Primary Author/Presenter: Douglas Bryant, MD

Paige Chase, MD and Stephen Schaaf, MD

Affiliation: Vanderbilt University Medical Center, Nashville, Tennessee.

Purpose: Describe the recurrence rate of ganglion cysts of the wrist and hand after ultrasound guided aspiration in

pediatric and young adult athletes which has not been reported. Additional outcomes include symptom resolution, return to sport, and complications following treatment.

Methods: This study is a case series examining 5 pediatric and young adult athletes with ganglion cysts of the wrist/hand seen in a PM&R sports medicine clinic by a single ACGME sports medicine fellowship trained physician. Each athlete was treated with an US-guided aspiration with or without an injection of corticosteroid (1 mL of Kenalog 40 mg) following aspiration. Data was obtained via chart review.

Results: Median age of the athletes was 17, with a range of 14 to 23. There were 2 female and 3 male athletes. The sports that these athletes participated in included lacrosse, bowling, track and field, softball, and gymnastics. Two cysts emanated from the dorsal scapholunate interval, 2 from the dorsal radiocarpal joint, and one dorsal between the dorsal third and fourth metacarpal space. The mean size of the ganglion cysts was 1.76 cm, with a range of 1.4 cm to 2 cm. All 5 athletes had a successful ultrasound-guided aspiration of their ganglion cyst. Three of the 5 athletes received an injection of corticosteroid. Following their procedure, all patients reported resolution of their wrist or hand pain and were able to return to full participation in their respective sports. There were no post-procedure complications noted. One of the 5 athletes had recurrence of their symptoms and ganglion cyst as confirmed on ultrasound at secondary follow up at 307 days.

Conclusions: Our study demonstrated a 20% recurrence rate of ganglion cysts in the wrist and hand in pediatric and young adult athletes following US-guided aspiration. All athletes had symptom resolution and returned to sport immediately following their procedure. Thus, US-guided aspiration is an effective and safe treatment option for ganglion cysts of the wrist and hand in pediatric and young adult athletes. Further studies on a large scale are indicated.

Significance: The best management strategy of wrist and hand ganglion cysts in pediatric and young adult athletes remains underreported. Non-operative intervention including US-guided aspiration is beneficial and has advantages over operative management.

Acknowledgments: Department of Physical Medicine and Rehabilitation, Vanderbilt University Medical Center.

TOPIC: Education

STUDY: Survey

Trauma Informed Sport Mobilizing Trauma Informed Practice into Action

Primary Author/Presenter: Beatrice Caballero, MD

Ashwin Rao, MD, FAMSSM and Bridget Whelan, MPH

Affiliation: University of Washington, Seattle, Washington.

Purpose: Childhood trauma is a pervasive public health issue thought to have significant impact on sport performance. This study measured the level of understanding of trauma informed sport among high school (HS) coaches and athletic trainers and assessed the need for education on trauma-sensitive practices.

Methods: HS coaches and trainers (>18 years old) from the Seattle metropolitan area completed a survey between December 2021 and June 2022. Primary outcomes were understanding of trauma-informed sport and adverse childhood experiences (ACEs). Secondary outcomes were level of comfort providing resources for trauma-exposed athletes, interest in training, and barriers to receiving training in trauma-informed sport.

Results: Among the 45 participants (36 coaches, 9 athletic trainers), 69% (n = 31) either “disagree or strongly disagree” with understanding the meaning of trauma-informed sport and 73% (n = 33) of participants reported never applying trauma-informed practices in their career. 93% (n = 42) “agree or strongly agree” retraumatizing an already traumatized athlete in a new setting (home versus sport environment) can occur unintentionally. 87% (n = 39) were “somewhat or very comfortable” with recognizing signs of trauma in young athletes with 93% (n = 42) “somewhat or very comfortable” in referring athletes to additional resources and support systems. 96% (n = 43) participants “agree or strongly agree” there is a connection between ACEs and sports performance. 82% (n = 37) “disagree or strongly disagree” with having enough resources needed to engage in trauma-informed sport. 93% of participants (n = 42) attested they are interested in learning more about trauma-informed sport, while citing cost and time as barriers.

Conclusions: Almost all participants agree there’s a connection between ACEs and sports performance and that athletes can be unintentionally triggered in a sport environment. However, nearly 70% of participants do not understand what trauma informed sport means. Only 18% have enough resources to engage in trauma informed sport. This study highlights the important role for education on structured techniques to redesign sport to counteract the impacts of trauma.

Significance: Competitive sport can trigger or amplify ACEs. It is essential to equip the youth-serving community to respond to the unique needs of trauma-exposed athletes to mitigate negative experiences while promoting positive outcomes on and off the field.

TOPIC: Rehabilitation

STUDY: Survey

Adherence to Physical Therapy in a Primary Care Residency Office

Primary Author/Presenter: Brian Chan, DO

Alana Payne, DO and Bryan Botti, MD

Affiliation: Mainline Bryn Mawr Family Medicine Residency, Bryn Mawr, Pennsylvania.

Purpose: The purpose of this study is to assess adherence rate, risk factors and reasons for nonadherence with a physical therapy regimen prescribed in a primary care setting to improve patient care.

Methods: Epic EMR was used to compile a list of 140 patients who had been given a PT referral within the last year by a single sports medicine physician in a primary care clinic. Patients were contacted by phone or portal to determine if they had attended physical therapy. Data was also collected regarding the patients’ age, gender, zip code, ICD-10 code, and reason (if they had not attended PT).

Results: The data showed that knee and shoulder pathologies received the majority of PT referrals. More female patients (51%) were referred to PT than male patients (45%), and a greater proportion of patients who do not identify as male or female did not attend PT (9.1%). The average age for patients receiving a PT referral was 48.4. In general, most patients (56.7%) surveyed stated that they were adherent to PT. However, a sizeable number of patients did not reply to the survey (25.7%). Those that were not adherent (17.6%) listed time constraints (30.3%) or other factors (33.3%) as

limiting their participation with self-resolving of the problem being the next most common reason (24%). Additionally, more patients of a low socioeconomic status did not attend PT (27.3%), while more patients of a high SES did attend PT (86.7%).

Conclusions: In this study of 140 patients, we found that patients in general are adherent to PT. While none of the differences between groups of risk factors in our data are statistically significant, we did have some interesting findings ($P < 0.1$): differences in gender and SES status. Future studies should include more patients expanding the entire practice to better assess these characteristics.

Significance: The results of this study will further enable providers at our practice to account for biopsychosocial factors that influence adherence to PT referrals and overall patient care.

Acknowledgments: Special thanks to Georgia Montone, Stephanie Kjelstrom, and Sharon Larson at Lankenau Institute for Medical Research (LIMR) for their aid in statistical analysis.

TOPIC: Concussion

STUDY: Cohort

Autonomic Pupillary Light Reflex (PLR) Markers in Patients After Mild Traumatic Brain Injury (MTBI)

Primary Author/Presenter: Alicia Chen, BS

Tyler Marx, MS, Saikaashyap Sarva, MBS, Kate Paulsen, BS, Arvind Balaji, MD, Brett Dusenberry, MD, James Dill, MD, and Mo Mortazavi, MD

Affiliation: SPARCC Sports Medicine, Rehabilitation, Concussion Center, Tucson, Arizona.

Purpose: Assess pupillary light reflex (PLR) autonomic response in mild traumatic brain injury (mTBI) in all age groups. We hypothesize that mTBIs will have a slower and smaller change in pupil size compared to non-mTBI patients.

Methods: A retrospective cohort study of 430 patients between the ages of 6 and 81 who had 1629 total clinical tests within 335 days of injury for concussive symptoms between October 28, 2019 and July 11, 2022. A standardized application was utilized at every visit to obtain PLR measures focused on maximum pupillary diameter (MaxPD) (mm), minimum pupillary (MinPD) (mm), and maximum constriction velocity (MCV) (mm/s).

Results: The data were compared to normative values from a control group totaling 4487 tests and were broken down into age ranges by groups of 12 starting with age 6 to 81. The age-correlated mean MaxPD was 6.44 ± 1.38 , 5.76 ± 1.14 , 5.64 ± 1.20 , 5.63 ± 1.18 , 5.10 ± 1.11 , and 5.27 ± 1.40 , MinPD was 3.97 ± 0.63 , 3.74 ± 0.61 , 3.63 ± 0.65 , 3.66 ± 0.67 , 3.38 ± 0.54 , and 3.27 ± 0.57 , and MCV 11.85 ± 7.37 , 9.98 ± 6.12 , 9.43 ± 5.94 , 9.80 ± 6.83 , 8.43 ± 5.06 , and 8.94 ± 5.30 . P -values for mean MaxPD were 0.0001, 0.4616, 0.2385, 0.0007, 0.1133, >0.0001 , and 0.9023, MCV was $>0.0001 \times 6$, and 0.0042.

Conclusions: The size of our pupils changes in the presence of light allowing us to adapt to our environment in what is known as the PLR. The presence of a PLR is indicative of an intact autonomic nervous system. PLR is potentially a quick and useful marker for post-concussive evaluation and autonomic assessment. The biomarkers MaxPD, MinPD, and MCV may be more useful in determining the concussive state of patients.

Significance: Based on our population, MaxPD, MinPD, and MCV all showed to be accurate biomarkers of suggested blunted autonomic response in patients with mTBI, with MaxPD significant in ages 54 and younger, MinPD in 3 out of 7 groups, and MCV in all age groups.

Acknowledgments: The Reflex team for the use of their technology and data for normative values.

TOPIC: Concussion

Diffusion Tensor Imaging Using 3 Tesla Magnetic Resonance Imaging in Patients With Persistent Post C

Primary Author/Presenter: Alicia Chen, BS

Alicia Chen, BS, Prem Thirunagari, BS, Hector Preciado, BS, David Lefkowitz, MD, Brett Dusenberry, MD, David Oakley, PhD, and Mo Mortazavi, MD

Affiliation: Rutgers University, New Brunswick, New Jersey.

Purpose: Using 3T MRI with DTI with respect to fractional anisotropy and mean diffusivity to highlight regional structural abnormalities and correlate with clinical tools such as CP Symptom Screening and Evoked Response Potential to understand the impact of regional injuries on concussion manifestation.

Methods: Seventy-two patients (ages 10-72) with mTBI and PPCS. 3T MRI with DTI performed under standardized protocol. DTI examined 70 ROI's, measuring fractional anisotropy (FA) and mean diffusivity (MD) per ROI >95 th percentile of MD values and the <5 th percentile of FA values deemed abnormal. Validated CP symptom screen and P300 Evoked response potentials (ERP) were obtained in all patients.

Results: There are 29 ROI's with ≥ 1 abnormal MD values, with the Anterior Thalamic Radiation, Striatal Inferior Frontal Cortex, and Corticospinal tract the most incident. Eighteen ROI's/29 ROI's with ≥ 1 abnormal MD values show left-right abnormality symmetry. There are 20 ROI's with ≥ 1 abnormal FA values, with the Forceps Major, Inferior Frontal Superior Frontal Cortex, and Superior Corticostriate the most incident. Six ROI's/20 ROI's with ≥ 1 abnormal FA values show left-right abnormality symmetry. Two groups were made from 72 patients; group 1 (patients with ≥ 1 abnormal MD/FA value in any ROI) and group 2 (patients without abnormal MD/FA values in any ROI). Group 1 ($n = 24$) dominant concussion profiles (CP): cognitive, cervical, and vestibular. Group 2 ($n = 47$) dominant CP: mood, cognitive and ocular. Likewise, changes in ERP in patients with (group 1) and without abnormal (group 2) DTI findings were evaluated. Group 1, $n = 24$, had P300 ERP of 7.33. Group 2, $n = 47$, had P300 ERP of 10.48 (P -value 0.06).

Conclusions: 25/72 patients (35%) had ≥ 1 abnormal MD and/or FA value in 71 ROI and commonly present in specific regions. They were also associated with reduced P300 ERPs (cognitive resources) as well as the cognitive fatigue profile. PPCS is a chronic condition often requiring a brain MRI. In tandem, DTI can help identify regional microstructural injuries that may correlate with cognitive and neurophysiologic deficits, and help guide targeted management.

Significance: Beyond this pilot, extending DTI research to compare regional abnormalities with specific clinical tools

used to evaluate clinical manifestations of regional injuries, such as cognitive fatigue, exercise intolerance, and vestibular deficits.

TOPIC: Running

STUDY: Other

Balanced Pacing Between the First and Second Halves in Marathon Races Correlates With Improved Overa

Primary Author/Presenter: Kaitlyn Chin, DO

Joseph Dadabo, MD, Allison Carroll, PhD, and Prakash Jayabalan, MD, PhD

Affiliation: Northwestern McGraw University/Shirley Ryan Ability Lab, Chicago, Illinois.

Purpose: Although several factors impact marathon performance, optimal pacing strategy for an individual during the race remains unknown. The present study evaluated the relationship between negative and positive split strategies with performance times in marathon runners in 4 World Marathon Majors.

Methods: Retrospective review of publicly available result databases of elite (defined by the race, $n = 505$) and non-elite runners ($n = 505$) from the Chicago, New York, Tokyo, and London marathons 2017 to 2019. Negative splitting is defined as running the first half of the race slower than the second half of the race and positive splitting as the opposite. Statistical analyses were performed using SPSS.

Results: The mean age of elite runners was 30.1 and non-elite runners was 29.7. In both groups, the number of females was 213. Mean finish time for elite runners was significantly faster 2.35 hours versus non-elite runners 4.49 hours ($P < 0.001$). Frequency of negatively splitting races was 14% in elite compared to 11% of non-elite runners. When a runner negatively split, the difference in pace between each half of the race was less (-110 seconds) compared to non-elite (-376 seconds, $P < 0.001$). Across the full cohort, there was a significant correlation between a worse final place in the race and a greater difference in time between each half of the marathon ($r = 0.659$, $P < 0.001$) and was seen in elite ($r = 0.257$, $P < 0.001$) and non-elite runners ($r = 0.535$, $P < 0.001$). Regression analyses showed negative splitters had faster finish times by 1113 seconds ($P < 0.0001$). Univariate analyses revealed being an elite runner and male was associated with faster predicted finish times ($P < 0.0001$).

Conclusions: By utilizing data across multiple marathons, our study shows elite and non-elite runners who negatively split their race, had better race times, and placed higher overall. Elite runners generally had less differences in pace between the first and second halves of the marathon. Non-elite athletes tended to positively split their races and had greater variability of pace between splits which was associated with worse race times and place finish.

Significance: A balanced pace across each half of the race is associated with better marathon performance. This is the first study of its kind, to our knowledge, that provides pivotal information for runners planning their pacing strategies to improve performance.

TOPIC: Ultrasound

STUDY: Cohort

Evaluation of Percutaneous Ultrasonic Tenotomy (PUT) in Diabetic Patients and Potential Protective Role of Metformin

Primary Author/Presenter: Kuntal Chowdhary, MD

George Raum, DO, Connor Fultz, MD, Sidharth Sahni, DPT, and Kentaro Onishi, DO

Affiliation: University of Pittsburgh Medical Center (UPMC), Pittsburgh, Pennsylvania.

Purpose: To investigate the complication rate of percutaneous ultrasonic tenotomy (PUT) in diabetic patients, and evaluate the protective aspects of metformin in its ability to impact healing potentials in diabetics patients that had undergone PUT.

Methods: Retrospective chart review was performed for all cases of tendon injury treated with PUT between November 1, 2017 and December 31, 2020. Demographic factors and medical history prior to intervention, and complications following PUT were evaluated for each case. Descriptive statistics were completed to determine the rate of complications. Rates were compared using chi-square analysis (JASP Version 0.16.4).

Results: A total of 65 procedures utilizing PUT were identified through search of the electronic health record. The most common complication was increased pain or stiffness following PUT, and was identified after 11/65 procedures (16.92%). Of the 9 procedures performed on patients with diabetes, increased pain or stiffness occurred in 1/6 (16.67%) patients taking metformin, and in 1/3 (33.33%) patients not taking metformin. This value was not statistically significant. When pre-diabetic patients were also included in the subgroup analysis, an increase in pain or stiffness following the procedure occurred in 2/7 (28.57%) patients not taking metformin versus 1/6 (16.67%) patients taking metformin. This value was not statistically significant. The other complication identified was a deep venous thrombosis. This did not occur in a patient with diabetes.

Conclusions: Strong evidence has demonstrated diabetes mellitus is associated with a higher risk of tendinopathy, and contributes to poorer outcomes of healing. Metformin has been identified as a possible treatment for tendinopathy by inhibiting inflammatory mediators during tissue stress. In our sample, diabetics had poorer outcomes following PUT, and patients on metformin had a lower complication rate of development of increased pain/stiffness.

Significance: While not statistically significant, the findings of this study are suggestive of a protective role played by metformin in patients with diabetes mellitus, and warrants further evaluation with a larger patient sample size.

TOPIC: Pediatrics

STUDY: Other

Athletic Identity and Injury Patterns in Pediatric Ballet Dancers

Primary Author/Presenter: Jane S. Chung, MD

Ashley Erdman, MBA, Sophia Ulman, PhD, Emily Stapleton, PsyD, Shane Miller, MD, Jacob Jones, MD, Jessica Dabis, DPT, and Henry Ellis, MD

Affiliation: Scottish Rite for Children, Frisco, Texas.

Purpose: Many dancers specialize at an early age and train year-round. Purpose was to evaluate for correlations between sport specialization characteristics, including athletic identity

(AI) and injury patterns in pediatric ballet dancers, as high AI is a risk factor for mental health concerns after injury.

Methods: Pediatric pre-professional ballet dancers who train en pointe were enrolled in an AMSSM funded study. The Athletic Identity Measurement Scale (AIMS) questionnaire was administered to measure the degree to which each dancer identified with the athlete role, comprised of 3 subscales: social identity (SI), exclusivity (EX), and negative affectivity (NA). Injury history was also collected.

Results: Data were collected on 46 female dancers (age 14.4 $\pm$ 1.9 years). Average total AI was 54/70, with SI, EX, NA subscores of 19/21, 19/28, 11/14, respectively. Dancers reported a mean of 10.3 years of dance experience, with 3.3 years of training en pointe. Total AI ($P = 0.04$), SI ($P = 0.02$), and NA ($P = 0.01$) subscores exhibited moderate correlations to age, increasing in older dancers. Increased practices/week were correlated to total AI, EX, NA subscores ($P = 0.02$, $P = 0.04$, $P = 0.04$, respectively). Number of years en pointe demonstrated a weak correlation to EX ($P = 0.049$). Dancers who reported past injury had an increased SI subscore ($P < 0.01$), but no difference in EX or NA subscores compared to non-injured dancers. Past injury was more prevalent with increased age, years in dance, and years en pointe ($P < 0.01$, $P = 0.01$, $P = 0.02$, respectively).

Conclusions: Pediatric ballet dancers strongly identify with sport. Older dancers tended to identify more strongly as athletes. Those who practiced more identified more exclusively as dancers, with both groups reporting higher AI and propensity for negative affect with sport setbacks. Dancers with past injuries were more likely to strongly identify as athletes. More training years en pointe correlated with increased degree of self-worth tied to sport.

Significance: This information may be useful for providers, since a pediatric ballet dancer's self-identity is strongly shaped by sport and increases with training volume and age, putting them at risk for negative mental health outcomes following setbacks.

Acknowledgments: This study is supported by the AMSSM Foundation grant.

TOPIC: Musculoskeletal

STUDY: Cohort

Knee Injury Prevalence in Division I Men's Ice Hockey Players Over a Seven Year Time Period

Primary Author/Presenter: Dustin Collins, MD

Megan Kusner, ATC, Tyler Daigneault, ATC, Kendra McCamey, MD, Angela Pedroza, MPH, 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 investigate the prevalence of knee injuries for division I Men's Ice Hockey Players during a 7 year time frame to highlight the importance of the continued need for strength training for injury prevention of the knee in elite ice hockey players.

Methods: Cohort study involving 189 Men's Ice Hockey student athletes at a division I university over a 7 year time period from 2016 to 2022. Athletes were asked before each season via questionnaire if they have suffered an injury to their knee and to give details and date of injury. Data was translated into a strict percentage of players with knee injuries divided by those who did not report a knee injury.

Results: Out of the 189 responses, 14 student athletes reported either a previous or current knee injury (7%). Year 2016 had the highest self-reporting percentage of knee injury at 4/28 (14%) and the year 2020 with the lowest percentage at 0/25 (0%). It is noted the year 2020 had less man games played in that year secondary to the COVID-19 pandemic. Most common type of knee injury reported included meniscal injury (42%), followed by ACL (28%), MCL (28%) and PCL (14%) respectively. It is noted that the some respective injuries occurred at the same time as another respective injury.

Conclusions: Given the average number of players with current or previous knee injury in any given year was 7% shows that knee injury is a common and prevalent injury among division I Men's Ice Hockey players. This is consistent when compared to other studies. Additionally, of the knee injuries sustained the most common was internal derangement such as meniscus, ACL and PCL.

Significance: Given the prevalence of knee injuries in the division I Men's Ice Hockey population there should be continued attention towards highlighting the importance of continued strength training for injury prevention of the knee in elite ice hockey players.

Acknowledgments: I would like to thank Katie Walker, ATC for the help in data collection for this study.

TOPIC: Epidemiology

STUDY: Survey

Investigating the Prevalence of Cubital Tunnel Syndrome Among Rock Climbers

Primary Author/Presenter: Kevin Connolly, DO

Christopher Lutrzykowski, MD, Alexander Campbell, DO, and Mark Schuenke, PhD

Affiliation: Maine-Dartmouth Family Medicine Residency Program, Augusta, Maine.

Purpose: Upper extremity injuries are the most common among rock climbers. We aim to investigate the prevalence of self-reported symptoms suggestive of cubital tunnel syndrome (CuTS) in a sample of rock climbers & to explore associations between these symptoms, age, sex, skill level, & climbing frequency.

Methods: IRB approved, prospective observational cohort study, anonymous online survey of adults 18 or older who climbed on average at least 1x/month for the last year. Recruitment was held at 2 indoor rock climbing gyms for 10 weeks. A link was shared using in-person sessions, display posters & social media. We designed loose & strict diagnostic criteria for CuTS to classify participants (see below).

Results: 191/205 participants were eligible. 111 (58%) male, 78 (41%) female, 2 (1%) unidentified. 99 (52%) aged 18 to 29, 52 (27%) 30 to 39, 26 (14%) 40 to 49, 8 (4%) 50 to 59 and 6 (3%) 60+. Respondents used Yosemite/V-Scale Grading to report their skill level. 11 (6%) identified as beginner, 73 (38%) intermediate, 85 (45%) advanced, and 22 (12%) expert. 17 (9%) climbed <5 h/mo, 68 (36%) 5 to 15, 60 (31%) 15 to 25 and 46 (24%) >25. 78/191 (41%) reported at least 1 symptom of either pain, paresthesia, or numbness in their fourth or fifth fingers in the last year, meeting the loose criteria. 44/191 (23%) also had at least 1 elbow symptom, meeting the strict criteria. When we eliminated other causes of neuropathic symptoms, 37/191 (19%) met the loose criteria & 15/191 (8%) the strict. After eliminating other activities (e.g., work) that may cause symptoms, 26/191 (14%) met the

loose criteria & 16/191 (8%) the strict. With both confounders eliminated, 14/191 (7%) met the loose criteria and 6/191 (3%) the strict.

Conclusions: In this sample of rock climbers, we estimate that the prevalence of symptoms suggestive of CuTS is 23% to 41%. After eliminating other causes of neuropathic symptoms that might confound these results, the range becomes 8% to 19%. When eliminating other activities that may cause symptoms, we estimate the prevalence of symptoms suggestive of CuTS is 8% to 14%. After eliminating other causes of neuropathic symptoms in this group, the range becomes 3% to 7%.

Significance: Rock climbing is increasingly popular & is now included in professional competitions. CuTS is a common nerve entrapment syndrome & ulnar nerve irritation can impact athlete enjoyment & performance, but there are few studies of this in rock climbers.

Acknowledgments: Thank you to Nancy Fischer, W. Greg Feero, MD, PhD, and the MDFMR Sports Medicine Fellowship Faculty.

TOPIC: Running

STUDY: Other

Relationship Between Gait Biomechanics and Injury in Adolescent Marathon Runners

Primary Author/Presenter: Joseph Coppiano, MD

Frances Tao, MD, MPH, Sydnie Vo, MD, Kuan-Ting Chen, Nelson Boland, MD, Summer Runestad, ATC, Joshua Goldman, MD, MBA, and Emily Miller, MD

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

Purpose: Despite the growing popularity of adolescent distance running, little is known about biomechanical factors that increase injury risk. The aim of this study is to assess whether adolescent pre-marathon gait biomechanics can serve as predictors of running-related injury during marathon training.

Methods: High school (HS) students participating in a marathon training group completed baseline gait analysis including drop jump Q-angle, hip drop and gait Q-angle. Injury data were collected through weekly surveys completed by subjects. A Welch's *t*-test was used with statistical significance determined at a *P*-value less than 0.05 to compare injured to non-injured runners.

Results: A total of 76 HS (40 male, 36 female, mean age 15.9) runners were recruited. 18.4% reported an injury. There was a statistically significant difference in the mean right-sided gait Q-angle in injured runners compared to non-injured runners (15.27 vs 12.66, *P* = 0.01). The mean left-sided gait Q-angle trended higher in injured runners compared to non-injured runners, but did not reach statistical significance (13.61 vs 12.76, *P* = 0.366). There were no statistically significant differences in mean drop jump Q-angle between injured and non-injured runners on either the right (12.97 vs 12.67, *P* = 0.85) or the left (13.35 vs 13.53, *P* = 0.91) side. Similarly, there were no statistically significant differences in mean hip drop between injured and non-injured runners on either the right (3.54 vs 4.17, *P* = 0.49) or the left (4.09 vs 3.92, *P* = 0.84) side.

Conclusions: The overall injury rate of 18.4% is similar to previously reported injury rates for adolescent marathon

runners. A right-sided gait Q-angle greater than 15 degrees was associated with increased injury risk during a 28-week marathon training program. Drop jump Q-angle and hip drop angle were not associated with injury. A pre-season gait analysis may assist in assessing risk of running-related injury during a marathon training cycle.

Significance: When considering risk factors, gait Q-angle shows promise as a predictor for adolescent running-related injury. These results help guide future studies to assess if strengthening biomechanical weaknesses in gait could lead to a decrease in injury.

Acknowledgments: AMSSM Young Investigator Grant; Students Run Los Angeles; Orthopedic Institute for Children; NIH/National Center for Advancing Translational Science (NCATS) UCLA CTSI Grant Number UL1TR001881; Anthony Luke, MD MPH; RunSafe.

TOPIC: Pediatrics

STUDY: Other

Efficacy and Tolerance of Extracorporeal Shockwave Therapy in Adolescents With Lower Extremity Sports-Related Injury

Primary Author/Presenter: Stephanie DeLuca, MD

Kevin Vu, MD and Adam S. Tenforde, MD

Affiliation: Spaulding Rehabilitation Hospital/Harvard Medical School, Charlestown, Massachusetts.

Purpose: We describe findings from a QI initiative on the efficacy, safety, and tolerance in adolescent athletes treated with ESWT for lower-extremity sports-related injuries. We hypothesized that this population would respond favorably to ESWT without adverse effects.

Methods: A retrospective chart review was performed from November 2017 to 2022 for all patients receiving ESWT for lower extremity musculoskeletal injuries. All patients were treated with R-SWT (*n* = 7) or C-SWT (*n* = 3). Abstracted data included patient demographics, clinical and treatment characteristics, pre- and post-intervention functional outcome measures, safety outcomes, and patient tolerance.

Results: Ten adolescent athletes were identified as receiving treatment with ESWT for lower extremity musculoskeletal injuries. Most were runners (*n* = 7, 70%) with a mean age of 16.9 ± 0.88 years and average symptom duration of 9 ± 6 months. Patients received an average number of 5.2 ± 1.6 treatments. 7 athletes (70%) met their respective minimal clinically important difference for functional outcome measures. No adverse events or long-term complications were reported. All athletes returned to their respective sports.

Conclusions: Our findings suggest that a majority of adolescent athletes with lower extremity sports-related injuries, specifically tendinopathies, respond favorably to ESWT. ESWT in combination with an exercise program can be an effective, safe treatment option for adolescent athletes.

Significance: To our knowledge, this is the first reported case series describing the use of ESWT in adolescent athletes with lower extremity sports-related injuries. With further research, ESWT may become a standard treatment option for adolescents.

Acknowledgments: Spaulding Rehabilitation Hospital.

TOPIC: Musculoskeletal

STUDY: Cohort

Function of the Intrinsic Muscles of the Foot by Active Exercise and Electrical Stimulation

Primary Author/Presenter: Samantha Dominguez, BA

Mark Holling, PT, Jacob Baird, BS, and James Jastifer, MD
Affiliation: Department of Orthopaedic Surgery, Homer Stryker M.D. School of Medicine, Western Michigan University.

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, and the correlation to targeted exercises have never been quantified.

Methods: Thirty healthy volunteers underwent testing of the intrinsic muscles of the foot including 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 short foot exercise. These weight bearing measurements were taken using validated digital imaging software.

Results: The foot length and height measurements were statistically significantly different between tests (both $P < 0.0001$). Pairwise comparisons were made utilizing the Bonferroni post hoc test that demonstrated a statistically significant difference between the baseline foot length and height measurements and all other testing conditions (all $P < 0.05$) but no difference between short foot exercise and ESTIM for height or length (all $P > 0.109$).

Conclusions: This study demonstrates that the intrinsic muscles of the foot contribute to arch height and foot length with weight bearing. Short foot exercise and ESTIM had similar effects on arch height and foot length confirming that short foot exercise recruits the intrinsic muscles similarly to ESTIM.

Significance: The short foot exercise has a similar effect on foot shape as electrical stimulation and may be considered by the clinician to strengthen the intrinsic muscles of the foot in athletes who have foot pain thought to be from intrinsic weakness.

TOPIC: Other

STUDY: Other

A 6-Week Pilot Exercise Program to Address Cardiometabolic Health

Primary Author/Presenter: Anthony D'Onofrio, DO

Caroline Cohen, PhD, RD, Hairui Yu, PhD, Erin Delaney, MD, Hudson Honeywell, MS2, Tapan Mehta, PhD, and Irfan Asif, MD

Affiliation: University of Alabama Birmingham, Sports and Exercise Medicine Fellowship, Birmingham, Alabama.

Purpose: The purpose of this prospective observational study was to examine markers of cardiometabolic disease before and after referral to a 6-week community-based exercise facility. This referral was offered as part of an exercise counseling initiative at a family medicine practice.

Methods: Patients were offered a free 6-week membership to local YMCAs as part of exercise counseling and chronic disease management. Systolic/diastolic BP (SBP/DBP), Hgb A1c (A1C), and weekly minutes of exercise (WME) were assessed before and after intervention. Pearson Chi-Square tests, Wilcoxon tests, and t -tests were conducted to detect statistical differences (alpha level = 0.05).

Results: Three-four patients participated in the 6-week pilot exercise program (avg age = 46 y/o, range 29-71 y/o; 85% female; 67.6% = African American, 29.4% = Caucasian; avg WME at baseline = 30.88). 79.4% reported pre- and post-intervention WME (mean change: +70.37 minutes, range -120 to +270 minutes, SD = 80.41). Among 32 patients (94%) who had BP measured at baseline and follow up visits, 10 patients (29.4%) improved from uncontrolled BP to controlled BP, and 13 patients (38.2%) maintained controlled BP, with overall decreased SBP (mean change = -4.21, ranging from -25.00 to +24.00; SD = 11.50) and decreased DBP (mean change = -0.103; range -4.07 to +3.87; SD = 1.94). Among 13 patients (38.2%) who had both baseline and follow-up A1C data, 10 patients (76.9%) achieved lowered A1c (mean change: -0.27; ranging from -0.81 to -0.10, SD = 0.29). There was a statistically significant increase in WME ($P < 0.0001$) and a significant decrease in SBP ($P = 0.03$) between the baseline and follow-up visits.

Conclusions: Cardiometabolic disease markers for patients with - or at risk for - hypertension and/or type II diabetes, along with weekly minutes of physical activity, can improve following a 6-week referral program from a family medicine clinic to local fitness facilities. In this study, SBP and WME were associated with improved outcomes. DBP and A1c also improved, though not to a statistically significant degree.

Significance: Local fitness facilities offer additional tools to increase physical activity in those with chronic diseases. This could lower healthcare costs and improve outcomes. Further follow up is needed to assess the long-term impact of such programs.

Acknowledgments: We would like to acknowledge Dr Ksenia Blinnikova and Ms Felicia Boyd for their contributions with the clinic referral program, and the YMCA of Greater Birmingham for their cooperation.

TOPIC: Other

STUDY: Survey

ExRxise Prescribing Exercise to PCC Patients to Improve Physical Activity Levels

Primary Author/Presenter: Bridget Doyle, DO, MPH

Kathryn Nutting, MD, Nicole Chin, MD, Jacqueline Greene-Roper, MD, Lauren Harriett, DO, Kyle Geissler, MD, and Lauren Splittgerber, MD

Affiliation: West Suburban Medical Center & PCC Community Wellness, Chicago, Illinois.

Purpose: Regular physical activity (PA) is known to improve health outcomes by preventing and treating many chronic diseases. The purpose of our project is to both track and increase PA levels among medically underserved patients using a PA as a Vital Sign (PAVS) questionnaire and an exercise prescription.

Methods: Using a validated PAVS questionnaire, a baseline assessment of PA levels among patients ages 12 to 65 years old was obtained at PCC, an urban clinic that serves low-income patients. Patients were also provided and counseled on a PA prescription with SMART goals/community-focused exercise resource handout. Through a phone survey, change in PA levels was analyzed and a needs assessment was completed.

Results: In 3 months, PAVS questionnaire results were obtained on over 1200 patients. The total average minutes per week of PA among all patients was 99.6 minutes. Over 200 patients were counseled on and provided with the ExRxise

handout. One hundred twenty-one of these patients were ages 18 to 65. The total average minutes per week of PA among adult patients who also received the ExRxise handout was 101.0 minutes. In a random sample of 20 PCC patients ages 18 to 65, a post-implementation phone survey showed 70% think they were more likely to engage in PA after discussing the PA prescription/resource handout with their provider; 75% think the PA handout was somewhat helpful, very helpful, or extremely helpful; and 45% referenced the PA handout at least 1 to 2 times per week. Overall, the PA prescription/goals and virtual resources were found to be the most useful. Lack of time, too many other responsibilities to attend to (work, children, etc.), and MSK-related pain were noted to be the most significant barriers to PA.

Conclusions: On average, patients at PCC Austin & Lake do not meet the CDC recommended PA levels of 150 minutes or more of moderate intensity exercise per week. In a random surveyed sample of 16 patients ages 18 to 65, their average PAVS score increased from 34 minutes to 136 minutes following being counseled on and provided the PA prescription/resource handout. This suggests the implementation of an exercise prescription in clinic increases overall PA levels.

Significance: A community intervention that involves screening for PA levels using PAVS as well as counseling patients on and providing patients with a PA prescription/resource handout may be an effective way to increase the likelihood of engagement in exercise.

Acknowledgments: Thank you to the providers, medical assistants, staff, and patients at PCC Austin and PCC Lake Health Centers who made this project possible.

TOPIC: Education

STUDY: Survey

In-Situ Sideline Emergency Simulation Improves Learner Confidence

Primary Author/Presenter: Gary Duncan, MD
G. Jake Starsiak, DO and Sarah Vengal, MD
Affiliation: OhioHealth, Columbus, Ohio.

Purpose: This in-situ simulation scenario was designed to improve learner's confidence in managing emergent conditions that may arise during sporting event coverage, including cervical spine injury, acute concussion, and cardiac arrest of a bystander emphasizing initial management and coordination of care.

Methods: This simulation was run in-situ on a football field. Two standardized patients in shoulder pads and helmets collided, with one incurring a cervical spine injury and the other with acute concussive symptoms. Meanwhile, acute cardiac management was performed on a manikin in the stands. A standardized survey tool was used to determine participants' reactions to and application of the course.

Results: All 4 tested learning objectives demonstrated a significant increase in learner confidence based on pre/post-simulation questionnaire mean values. Confidence in ability to describe the roles of sideline emergency providers ($P = 0.003$), model coordination of sideline medical services ($P = 0.013$), evaluate a patient with an urgent cardiac condition at an event ($P = 0.026$), and describe process and management of cervical spine injuries ($P = 0.015$) were evaluated on a 5-point Likert scale. 96.3% (26/27) of participants felt that the content was relevant to their work and that the simulation was

realistic. 100% (27/27) participants indicated that the in-situ environment was conducive to learning. Qualitative feedback included positive comments on the inclusion of emergency medical services, athletic trainers, and sports medicine physicians to promote coordination of care and that being on the field was helpful for simulating a realistic environment.

Conclusions: This simulation showed significant improvement in learner confidence regarding sideline medicine. Learners expressed statistical confidence in describing roles of sideline providers and coordination of care in a sideline emergency. This simulation involving multiple medical disciplines demonstrated confidence in management of urgent medical conditions during sporting events. Learners found the simulation applicable to their future practice.

Significance: An interprofessional in-situ simulation improves learners' confidence in sideline management and coordination of care in acute cervical injuries and cardiac events. EMS providers, residents, fellows, and faculty all benefitted from this simulation.

Acknowledgments: OhioHealth Learning Riverside Methodist Hospital Simulation Team for equipment use. Thank you to providers Dr Brad Gable, Dr Luke Simmons, Dr Jason Dapore, Dr Joe Ginty, Dr Jon Montemayor, and Worthington Fire & EMS for their time as volunteer educators.

TOPIC: Training

STUDY: Survey

Effects of COVID-19 Quarantine Restrictions on Training and Injury in Ballet Dancers

Primary Author/Presenter: Bianca Edison, MD, MS
Selina Shah, MD, Dana Sheng, MD, Tracy Zaslow, MD, Jacquelyn Valenzuela-Moss, BA, and Tishya Wren, PhD
Affiliation: Children's Hospital Los Angeles, University Southern California.

Purpose: The COVID-19 pandemic dramatically interrupted worldwide athletics. This study examined pandemic effects on dance and training participation for California youth dancers, training environments during shutdown, and incidence of injury prior to, during the pandemic, and after returning to studios.

Methods: This cross-sectional study surveyed 17 dancers (all female, mean age 13.8 years), comparing data surrounding the COVID-19 pandemic (before March 11, 2020, during quarantine, when studios reopened for classes). Questions assessed rates of dance instruction, ability to replicate studio environments, injury, and self-rated readiness. Descriptive stats include categorical variables and continuous variables.

Results: Prior to COVID-19, dancers trained a mean of 7.4 h/wk, down to 4.8 h/wk at home during quarantine. Strength training increased during the pandemic (3 h/wk vs 2.2 h/wk prior); 71% with no strength training pre-pandemic. Walking increased (0% pre-pandemic to 35% during quarantine). 76% of dancers reported COVID-19 interrupting training; 54% reporting 1 to 10 weeks of interruption and 46% reporting a longer interruption. During quarantine, most (94%) reported taking home virtual dance classes. Nearly half (8/17) of dancers had access to some equipment needed to adequately train, while 12% felt not having proper access. Training floor surfaces varied (47% on hardwood floors at home, 24% on carpet). No participants trained on any version of sprung flooring while at home. Many dancers used chairs (65%) or a barre (53%) to train. Upon returning to studios, 4

injuries occurred (no active injuries right before/during quarantine), 100% involving the lower extremity, 75% involving the foot.

Conclusions: COVID-19 proved challenging to dancers, limiting the ability to train at the level they had prior to imposed public health restrictions. Alternative options were implemented to continue dancing, including using hardwood floors and furniture at home. Volumes of dance-specific/cross-training decreased during quarantine, but strength-training and walking increased. These alternatives could have increased risk, resulting in lower extremity injuries.

Significance: Ballet is a physically and aesthetically demanding sport. As dancers return to studios and performance seasons, recognizing elements of deconditioning & alternative preparation can inform nuanced approaches to training and better reduce injury risk.

Acknowledgments: The team would like to acknowledge San Pedro Ballet and Diablo Ballet Studios for their gracious participation in the study.

TOPIC: NCAA

STUDY: Survey

Barriers to Women's Health Practices in Female Collegiate Athletes

Primary Author/Presenter: Madison Eichstadt, MD

Brenden Balcik, MD, Aaron Monseau, MD, and Nicholas Chill, MD

Affiliation: West Virginia University, Morgantown, West Virginia.

Purpose: There are few studies regarding hormonal contraception (HC) use and barriers to women's health in athletics. This research study will further assess the prevalence of HC, female athlete knowledge, perception and the potential barriers specifically regarding contraception.

Methods: A 22 question online survey was available from fall 2021 to fall 2022 competition season targeting division 1 female collegiate athletes. The survey included questions regarding menstrual and sexual health, and access/barriers to information regarding women's health. Study data were collected using REDCap electronic data capture tools then imported into SAS 9.4 with which all analyses were conducted.

Results: A total of 27 female athletes (ages 18-23) responded to the survey. A majority of respondents obtained their information regarding menstrual health from multiple sources with medical doctor (68.0%), friends (60.0%) and the internet (56.0%) being the most common. Respondents get their information regarding STIs from multiple sources with the internet (69.2%), medical doctor (57.7%) and friends (34.6%) being the most common. Information regarding contraception is most often obtained from a medical doctor (70.4%), followed by the internet (44.4%). A majority felt confident in their knowledge of women's health (59.3%) but 37.0% were neutral on the subject. The majority are not currently using HC (51.9%), however 2 respondents were unsure or did not know (7.4%). Most respondents did not feel there were barriers to information about women's health, the most common barriers to obtaining knowledge were stigma (29.2%) and fear of judgement (25.0%).

Conclusions: The results underline the variety of sources from which female collegiate athletes seek information

regarding women's health. While physicians are a significant resource, the internet is used almost as much which is unfortunate due to the amount of misinformation available. As physicians, we can improve upon the level of confidence an athlete has with regards to their knowledge base and remove the perceived barriers and misconceptions to HC.

Significance: To our knowledge, this is the first study to specifically evaluate female collegiate athletes' knowledge and perspective of women's health issues, and reveals a potential knowledge gap that would benefit from additional study and education.

Acknowledgments: The authors would like to acknowledge the WVU Athletic Training staff.

TOPIC: Musculoskeletal

STUDY: Case-Control

Lateral Meniscal Overhang is Associated With ACL Tears: A Retrospective Review

Primary Author/Presenter: Joseph Elphinstone, MD, MS

Hank Debell, MD, Samuel Schick, MD, Garrett Jeebles, BS, Wilson Narducci, BS, Eugene Brabston, MD, and Amit Momaya, MD

Affiliation: Phoebe Putney Memorial Hospital, Albany, Georgia.

Purpose: To assess the frequency and degree of posterior overhang of the lateral meniscus (LMO) in patients with ACL tears compared to uninjured individuals.

Methods: Case control study evaluating knee magnetic resonance imaging. Demographics, Lateral meniscus diameter, LMO, knee flexion angle, were measured and compared between patients with ACL tears and uninjured controls. Difference in average lateral meniscus overhang between ACL injured and control groups was tested using a paired *t*-test, and categorical variables were compared using Pearson χ^2 .

Results: A total of 117 knees with ACL tears and 89 control knees without injury were evaluated. Age (30.4 vs 30.5 years) and race did not significantly differ between control and ACL tear groups; however, significantly more controls were female (53.4% vs 76.1%; $P = 0.001$). Measurable LMO was found in 42.7% of patients with ACL tears, compared to 4.5% uninjured knees. Average LMO was significantly greater in patients with ACL tears (2.2 mm) compared to the control group (0.08 mm; $P < 0.001$). Within the ACL tear group, age, race, tibial plateau diameter, and knee flexion angles did not differ between those with or without LMO. However, the proportions of male and female patients exhibiting LMO versus those lacking LMO approached, but did not reach statistical significance (LMO: 65.3% female, without LMO: 45.5% female $P = 0.039$).

Conclusions: Patients with ACL injury demonstrate a significant rate of lateral meniscal overhang, compared to uninjured controls. The clinical significance of this is unknown and requires further investigation.

Significance: ACL and meniscal injuries commonly present together. However, no prior group has previously described the posterior translation of the lateral meniscus in the setting of ACL tears.

Acknowledgments: We would like to thank Dr Carl Narducci with his help in image acquisition and measurement.

TOPIC: Education

STUDY: Cohort

ITE Score Comparison among FM Residents With/Without a Longitudinal Sports Medicine Track

Primary Author/Presenter: Micah Furr, BS

Dmitry Tumin, PhD and Megan Ferderber, MD, MPH

Affiliation: Brody School of Medicine, Greenville, North Carolina.

Purpose: There is little data on the influence of sports medicine (SM) clinical tracks on musculoskeletal (MSK) knowledge of family medicine (FM) residents. This study compares in-training examination (ITE) results of FM residents with and without SM track participation.

Methods: A single center, retrospective study was completed on FM residents from the 2018 to 2024 graduating classes who completed the ITE from 2017 to 2021. Resident data from the ABFM and demographic data collected from residency records was extracted. Microsoft Excel and Stata 16.1/SE were used for data collection and analysis. Residents who had disrupted residency training were excluded from this data.

Results: Over the course of 5 years, a total of 85 FM residents were considered for evaluation in this study, with 7 being excluded due to disruptions in their residency education. Of the 78 included, 64.1% were MD trained, and 41% male. 11 residents (14.1%) participated in the SM track. A total of 164 scores were analyzed (55 PGY1, 55 PGY2, and 54 PGY3). On multivariable analysis controlling for gender and degree, ITE MSK scores increased among both SM track participants (+77 points/yr, $P = 0.001$) and non-participants (+39 points/yr, $P = 0.001$). By PGY3, SM track participants were performing significantly better on the MSK portion of the ITE (+87 points compared to non-participants, $P = 0.045$). No significant differences were noted in ITE MSK scores between MD and DO residents (-7 points, $P = 0.778$).

Conclusions: While no significant difference in MSK ITE scores was shown between SM track participants and non-participants between PGY1 and PGY2, PGY3 SM track residents were performing significantly better compared to non-participants of the track. A SM track is intended to enhance exposure to MSK conditions; our research suggests that this increase in exposure is associated with an increase in MSK knowledge as measured by ITE scores.

Significance: MSK conditions are commonly managed by primary care physicians. Enhanced MSK exposure in FM residency through a SM track is demonstrated to increase MSK knowledge, which may lead to more accurate diagnoses/treatment plans for patients.

TOPIC: Pediatrics

STUDY: Other

Trends of Non-Operative Care for Medial Ulnar Collateral Ligament Injury That Lead to Operative Care

Primary Author/Presenter: Tyler Garriss, BS

Beth Weinman, DO

Affiliation: Medical College of Wisconsin, Milwaukee, Wisconsin.

Purpose: Identify if amount of recovery time in post non-surgical MUCL treatment is related to eventual surgical MUCL treatment. We are interested in correlating types of MUCL injury, types of non-surgical management, and return time to sport to eventual need for reconstruction surgery.

Methods: This study is a retrospective chart review and data was collected from the Children's Wisconsin Epic medical records ranging from 2015 to 2021. Cases were compiled of MUCL injuries in adolescent athletes (aged 11-18 years). Athletes with neuromuscular conditions, connective tissue conditions, multiple MUCL injuries, or prior elbow surgery were excluded.

Results: Forty-one adolescent athletes were found to have met the inclusion criteria for the study. The population is as follows, 32 males and 9 females in sports including but not limited to baseball, football, gymnastics. The predominant sport was baseball with 20 players, 17 of them being pitchers. Mean age of all patients was 14.8 years old. In total, there were 13 full MUCL tears, 10 partial MUCL tears, and 18 MUCL sprains. It was statistically significant that those that did have a surgical reconstruction had a longer return time to their respective sport by about 205 days.

Conclusions: Patients that require surgery for their MUCL should expect a longer return time to their respective sport. Although logistic modeling did show support for certain non-surgical treatments it was not statistically significant. 75.6% (31/41) of patients returned to their respective sport, which was slightly lower than the currently reported 85%.

Significance: Sport played, type of tear, gender, and type of non-surgical treatment was found to be statistically insignificant regarding return time. A larger sample size may be able to answer more questions.

Acknowledgments: Special thank you to Nicholas Giebel with the Orthopaedic department, as well as Ryan Conrardy and Kai Yang with the Biostatistics department.

TOPIC: Other

STUDY: Cohort

Relationships Between Movement Efficiency, Body Composition, and Lower Body Strength in Firefighters

Primary Author/Presenter: Alecia Gende, DO

Andrew R. Jagim, PhD, Joel Luedke, MS, Ward Dobbs, MS, Thomas Almonroeder, DPT, PhD, Jennifer Fields, PhD, Margaret T. Jones, PhD, and Jacob L. Erickson, DO

Affiliation: Department of Sports Medicine, Mayo Clinic Health System, La Crosse, Wisconsin.

Purpose: Movement screens identify mobility restrictions and evaluate movement quality, which may be associated with strength. The purpose of this study was to examine relationships between movement efficiency and lower body strength, using an isometric mid-thigh pull among a mixed cohort of firefighters.

Methods: Firefighters ($n = 71$; Age: 36.5 ± 9.0 years.; Height: 1.81 ± 0.06 m; Weight: 91.2 ± 13.10 kg; BMI: 27.9 ± 3.8 kg/m²) completed a body composition assessment and Isometric Mid-Thigh Pull to assess lower body maximal strength on a bilateral force platform and an automated movement efficiency test consisting of 7 individual movement tasks. A movement efficiency score was then calculated.

Results: The overall movement efficiency score was 73.02 ± 10.70 out of 100. Percentile rankings for 5, 25, 50, 75 and 95% were 51.9, 64.8, 73.9, 80.6, and 89.2, respectively. No significant relationships were observed between movement efficiency and measures of lower body strength assessed by the IMTP. Height ($r = 0.351$), body mass ($r = 0.404$), fat-free mass ($r = 0.494$), and fat-free mass index ($r = 0.422$) were all

positively associated (No significant relationships were observed between movement efficiency and measures of lower body strength assessed by the IMTP). Height ($r = 0.351$), body mass ($r = 0.404$), fat-free mass ($r = 0.494$), and fat-free mass index ($r = 0.422$) were all positively associated ($P < 0.01$) with lower body strength.

Conclusions: The current cohort of firefighters exhibited an adequate degree of movement efficiency; however, this was not associated with lower body strength during an isometric task. Firefighters who were taller, heavier, had more fat-free mass or had a higher fat-free mass index had greater lower body strength.

Significance: Firefighters appear to have adequate movement efficiency, which does not appear to translate to greater lower body strength. Future work should explore relationships between movement efficiency and dynamic tasks, performance indices, or injury risk.

TOPIC: Training

STUDY: Cohort

Physiological Demands of a Self-paced Firefighter Air-management Course and Determination of Work Efficiency

Primary Author/Presenter: Alecia Gende, DO

Andrew R. Jagim, PhD, Joel Luedke, MS, Ward Dobbs, MS, Thomas Almonroeder, DPT, PhD, Jennifer Fields, PhD, and Margaret T. Jones, PhD

Affiliation: Department of Sports Medicine, Mayo Clinic Health System, La Crosse, Wisconsin.

Purpose: The purpose was to quantify physiological demands of an air management course and create a formula for work efficiency characterizing occupational performance. A secondary aim was to evaluate physiological demands and work efficiency based upon weight and examine predictors of work efficiency.

Methods: Firefighters ($n = 57$; Age: 37.2 ± 8.4 years; Height: 182 ± 6.9 cm; Weight: 90.8 ± 13.1 kg; BMI: 27.8 ± 3.6 kg/m²) completed an AMC wearing a self-contained breathing apparatus and protective gear. Course completion time, air consumption, and distance were recorded. Firefighters wore a sensor to assess HR, energy expenditure, and training impulse. 9 tasks completed until air supply was 200 PSI.

Results: Average completion time was 22:45 mm:ss, with a mean distance of 1.4 km and an average velocity of 2.4 m/s. Mean HR was 158.7 bpm equating to 86.8% of age-predicted max HR and a training impulse of 55 AU. Mean energy expenditure was 464 kcals and work efficiency was 49.8 km/PSI-1/s. Regression analysis determined that fat-free mass index ($R^2 = 0.315$; $B = -5.069$), body fat percentage ($R^2 = 0.139$; $B = -0.853$), FFM ($R^2 = 0.176$; $B = -0.744$), weight ($R^2 = 0.329$; $B = -0.681$), and age ($R^2 = 0.096$; $B = -0.571$), were significant predictors of work efficiency. When stratified by BMI, a BMI < 25 kg/m² ($n = 19$) completed more laps (mean difference [95% Confidence intervals]) (1.79 [1.24, 2.35]), achieved a longer duration (272 [138,405] s), and completed more distance (0.22 [0.160,0.338] km). A lower BMI had a lower rate of air usage (-0.394 [$-0.609, -0.178$]), yet expended more energy (51.4 [3.96, 98.87] kcals).

Conclusions: The AMC is a highly aerobic task with near maximal heart rates reached throughout the course. Smaller

and leaner individuals achieved a higher degree of work efficiency during the AMC. The current measure of work efficiency provides the ability to characterize occupational performance, which allows for the standardized scoring of the AMC. Thus, the compilation of rankings within a department and annual comparisons could be computed.

Significance: Firefighters should regularly engage in aerobic training to optimize occupational performance while also striving for a healthy weight and body composition.

TOPIC: Pediatrics

STUDY: Survey

The Rate of Injury in Youth Sports Ages 5-14 Appears to be Higher Than Previously Reported

Primary Author/Presenter: Jesse Gettinger, MD

Kimberly Smith, PhD, Hairui Yu, PhD, and Irfan Asif, MD

Affiliation: UAB, Birmingham, Alabama.

Purpose: There is limited data on the rate of injuries in youth sports. The CDC reports 10% of children ages 5 to 14 participating in youth sports will get injured. The purpose of this study was to measure the rate of sports-related injury and identify factors associated with ED visits among young athletes.

Methods: A survey was sent to parents of athletes across several youth sports. They provided demographics and whether their child has been to an office or ED due to injury. Univariate analysis was conducted using frequencies and cross tables. Bivariate association examined outcome variables using χ^2 . A regression was used to determine factors that influence parents taking their child to the ED.

Results: Three thousand two hundred eighty-one participants completed the survey. 55.6% ($n = 1825$) were female, 71.2% White ($n = 2335$). 50.5% ($n = 1656$) reported their child had sustained an injury requiring evaluation in a medical setting. 21.8% reported household incomes $> \$125k$. 3.7% ($N = 108$) lived in a rural area, 84.1% ($N = 2451$) lived in urban areas. Parents who reported they were female ($Beta = 1.71$, $P < 0.001$), White ($Beta = 1.20$, $P = 0.042$), and had a higher household income ($P < 0.001$) were more likely to take their youth athlete for evaluation. Among those seen in a medical setting, a statistically significant difference ($P < 0.001$) was detected between female (46.7%) and male athletes (53.3%), White (75.5%) and non-White (24.5%), across urban-rural areas (e.g., rural: 3.1%), and household income (e.g., $> \$125,000$: 31.38%). In addition, in sports athletes of basketball, soccer, football, and baseball, their visits all significantly differentiated ($P < 0.001$) by rural-urban areas (e.g., male soccer& rural 47.8%; male soccer and urban 54.2%).

Conclusions: In our survey, over half of young athletes were reported to have sustained a sports-related injury that required medical attention. Factors associated with increased rates of doctor visits included higher-income families, Caucasian athletes, and female parents.

Significance: The incidence of injuries in youth sports appears to be significantly higher than previously described. Access to care among non-white young athletes living in low-income areas should be investigated.

Acknowledgments: Data source: DISQO and Coach Safely Foundation.

TOPIC: Musculoskeletal

STUDY: Survey

Does the Diagnosis and Treatment of Spondylosis Vary Based on a Physician Specialty and Region of Practice

Primary Author/Presenter: Daniel Givner, BS

Stephanie Gwin, MD, Stephen Stache, MD, Caroline Polansky, BS, and Christopher Mehallo, DO

Affiliation: Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, Pennsylvania.

Purpose: Spondylolysis is a common cause of low back pain in adolescents. Currently, there is no guideline for diagnosis and treatment of this condition. Our project aims to analyze the differences in the diagnosis and treatment of spondylolysis by physicians across specialties and regions.

Methods: A prospective survey was distributed to AOASM, AMSSM, AAPMR, AOCPRM, and NASS and completed by physicians across various specialties focusing on the differences in diagnosis and treatment of spondylolysis. Primary outcomes included physician's training, diagnostic imaging, and treatments prescribed. Secondary outcomes included current practicing location, additional imaging, and types of braces.

Results: Of 193 physicians, 56% trained in Family Medicine (FM), 16% in Physical Medicine and Rehabilitation (PM&R), 16% in Pediatrics, 3% in Orthopaedic, 0.5% in Neurosurgery, and 4.5% in Internal Medicine. Initial diagnostic imaging depended on the specialty as 58.9% of FM physicians ordered AP/Lat and oblique x-rays, while 43.8% of PM&R physicians ordered AP/Lat x-rays and 84.4% of Pediatric physicians ordered AP/Lat x-rays. If the initial x-ray imaging was negative, the majority of physicians subsequently ordered additional imaging, most commonly an MRI (87.5% FM, 71.9% PM&R, 96.9% Pediatric). However, for chronic spondylolysis there was no consensus on ordering additional imaging after initial x-rays. Regarding treatment, for acute spondylolysis, all specialties agreed on prescribing physical therapy and restricted activity yet disagreed evenly on prescribing bracing. For chronic spondylolysis, there was consensus among all specialties in ordering a pain consult and not prescribing bracing.

Conclusions: Diagnosis and treatment of spondylolysis can vary significantly across specialties. Different imaging modalities, additional imaging, and treatment options all vary based on a physician's training and specialty. These differences can lead to inaccurate management or added medical expenses for patients. Therefore, this study emphasizes the need for a universally accepted protocol for diagnosing and treating spondylolysis.

Significance: This study highlights the need for a centralized guideline for diagnosing and treating acute and chronic spondylolysis to prevent inaccurate diagnoses, and inappropriate imaging and treatments being performed across various specialties.

Acknowledgments: We would like to acknowledge and thank AOASM, AMSSM, AAPMR, AOCPRM, and NASS for letting us distribute our survey and all of the physicians for completing the survey as well. Lastly, I would like to thank Dr. Gwin, Dr. Mehallo, and Dr. Stache.

TOPIC: Musculoskeletal

STUDY: Cohort

Early Outcomes of an Intensive Multidisciplinary Lifestyle Medicine Pilot Program

Primary Author/Presenter: Anne Goldring, MD, MS

Jennifer Cheng, PhD and Heidi Prather, DO

Affiliation: Hospital for Special Surgery, New York, New York.

Purpose: Intensive lifestyle medicine (LSM)-based interventions have historically targeted chronic diseases (i.e., obesity, diabetes). We developed a LSM program for patients with musculoskeletal (MSK) conditions. This study aims to outline the initial results of patients who completed this program.

Methods: This was a prospective observational study of patients with lifestyle-related comorbidities and MSK conditions who completed an intensive interprofessional LSM pilot program at a single tertiary medical center between March 8 and September 8, 2022. Program data included patient attainment of goals, change in weight and body mass index (BMI), and PROMIS-10 physical and mental health scores.

Results: Thirteen patients completed the program (11 [85%] female, mean age 65 [SD 8] years, baseline weight 110.2 [24.5] kg, BMI 40.4 [8.5] kg/m², number of lifestyle-related comorbidities: 2 [1], PROMIS-10 mental health score 48.0 [7.7], PROMIS-10 physical health score 41.0 [5.5], willingness to make change score 8 [1], and confidence in making a change score 8 [1]). The main regions of MSK complaint included the knee (11), hip (3), and lumbar spine (2). Participant goals included weight loss (12), qualify for joint replacement (9), increase physical activity (8), decrease pain (3), improve sleep (2), improve health (1), and improve eating habits (1). On average, patients presented for 6 (6) visits over 13 (8) weeks. Of the 13 patients who completed the program, 8 (62%) achieved their goal or were on track. 9 out of 10 (90%) attained their goal to undergo surgery. By discharge, program completers attained a reduction in weight and BMI of 5.4 (5.0) kg and 1.6 (2.1) kg/m², respectively.

Conclusions: An intensive multidisciplinary lifestyle medicine program is not only feasible but effective in addressing MSK pain and lifestyle-related comorbidities in patients demonstrating sufficient willingness to change. A personalized, collaborative, interdisciplinary medical team that includes care for mental health, function, pain, and chronic disease enables patients to address these issues that are known to be linked, but often tackled separately.

Significance: Given the rising cost and burden of chronic lifestyle-related disease and MSK pain in the U.S., a new approach to care is necessary. This pilot program demonstrates the effectiveness of an interprofessional team approach.

Acknowledgments: The Simonsen Foundation and our research assistants Olivia Rau and Olivia Leopoldo.

TOPIC: Musculoskeletal

STUDY: Survey

Climbing Associated Injuries among the NYC Rock Climbing Community

Primary Author/Presenter: Jing Jing Gong, MD, MS

Kristen Kobayashi, DO, Michael Chary, MD, PhD, and Christine Chen, MD

Affiliation: NYP Queens, New York.

Purpose: Rock climbing is a recreational activity involving 44.5 million climbers world-wide. In this research project, we used an electronic questionnaire to assess the most common injuries that occur due to climbing and identified the percentage of those who were injured who sought out care.

Methods: We designed a web-based questionnaire to retrospectively survey climbers in NY indoor climbing gyms. Data collection occurred from September to December 2022. Exclusion criteria was age less than 18 years and incomplete survey. Taking into account gender, experience, and type of climbing, 94 participants completed the survey.

Results: Based on our results, 84.44% of survey participants ($n = 79$: 34 male, 45 female) reported sustaining a rock climbing injury. Of those who reported an injury, 51.32% reported a tendon or ligament strain only, whereas 30.26% reported multiple injuries. 57.33% reported their injury to be traumatic, whereas 38.67% reported their injury to be related to repetitive motion and overuse. 48.1% of all participants reported an upper extremity injury (61.8% in males, 37.8% in females). 43% of participants reported lower extremity injuries (23.5% males, 57.8% in females). The most frequently cited reason for seeking care among those who sustained injury was pain. 48% of the survey participants reported seeking care immediately, and 26.92% sought care within the first 2 weeks.

Conclusions: Based on the results of the survey less than half of climbers who reported injuries sought help immediately. Pain was the most cited reason for participants who sought medical attention. Interestingly a higher percentage of male climbers reported upper extremity injuries while more female climbers sustained lower extremity injuries.

Significance: Our survey is the first to our knowledge that focuses on the NYC climbing community. By understanding the local population and injury patterns is the first step to serving these recreational athletes.

Acknowledgments: Thank you mentors and thank you NYC climbing gyms for allowing us this opportunity!

TOPIC: Concussion

STUDY: Other

Equestrian Helmet Testing: MIPS Performance on a Novel Testing Approach

Primary Author/Presenter: Sara Gould, MD, MPH

Kevin Schrum, PhD, Dakotah Sicking, MSME, and Joseph Schwartz, MSBME

Affiliation: University of Alabama, Birmingham VA Health Care System, Birmingham, Alabama.

Purpose: The U.S. National Trauma Data Bank reported that equestrian sports accounted for 45.2% of sport-related head injuries in the registry, with 86% of these injuries being mild TBIs (mTBI). The Multi-directional Impact Protection System (MIPS) aims to reduce mTBI but current testing methods are limited.

Methods: Design: Optimization Study Setting: Mechanical engineering laboratory Participants: A 50th percentile Hybrid III anthropomorphic test device (ATD/dummy) The ATD was launched from an accelerated sled at 13.0 mph with a sudden stop propelling the ATD into a sandbox. DTS SLICE NANO data recorders plus triaxial linear accelerators and angular rate sensors were embedded inside the ATD head.

Results: The traditional helmet composed of a polycarbonate shell over Expanded Polystyrene (EPS) foam demonstrated an average peak deceleration of 70.45 G's; duration 18.63 milliseconds and a rotational velocity of 21.54 rad/s; duration 66.30 milliseconds. The MIPS helmet demonstrated an average peak deceleration of 131.37 G's; duration 11.60 milliseconds and a rotational velocity of 23.74 rad/s; duration 75.80 milliseconds. There was no statistically significant difference in rotational velocity ($P > 0.066$).

Conclusions: Current testing is conducted by fitting a helmet to a head form, which is then dropped or rolled from a prescribed height. These methods do not account for the load

placed on the neck and head through the angular momentum of the body. Our testing method, which more closely replicates equestrian falls, did not detect a reduction in rotational velocity with MIPS technology compared to the traditional EPS helmets.

Significance: Given the high burden of head injury associated with equestrian sports, it is imperative to develop technology to mitigate the risk of mTBI. Our testing method did not detect a reduction in rotational velocity with MIPS Helmets.

Acknowledgments: Sicking Safety Systems.

TOPIC: PPE

STUDY: Other

Improving Mass Preparticipation Cardiac Screening of the College Athletes Utilizing FM Residents

Primary Author/Presenter: Brian Grundt, DO

Iridi Pavliqoti, MD, Amanda Phillips, MD, MPH, and Luciano Mancera, MD

Affiliation: Louisiana State University Health Sciences Center at Ochsner University Hospital and Clinics, Lafayette, Louisiana.

Purpose: The purpose of this study is to evaluate the predictive value of the preparticipation cardiac screening tools at our university administered by family medicine residents.

Methods: The population studied is varsity student athletes currently enrolled at a D1 university with data aggregated and de-identified. The data was collected by reviewing the 2022 preparticipation exam (PPE) packets and EKGs for the athletes and comparing the number of positive answers on the AHA screening questionnaire to the number of athletes that received further cardiac testing.

Results: One hundred fifty-three athlete PPEs were reviewed and 32 athletes answered positively to 1 of the 14 questions posed in the AHA PPE questionnaire (20.9%). The 32 athletes' charts were reviewed and, of the 32 athletes, 8 required a cardiology evaluation and/or an echocardiogram prior to athletic participation. Thus, the positive predictive value of our screening questionnaire was 25%. One of the 153 athletes developed cardiac issues after PPE administration and required further cardiac testing (3.1%). The individual questionnaires were reviewed and, of the 51 total positive answers, 38 were related to personal history (74.5%), 10 were related to family history (19.6%), and 3 were related to physical exam (5.9%). Upon further evaluation, 9 of the positive answers were related to non-cardiac issues (28.1%). Additionally, it was noted that of the 32 athletes, 26 of them had inconsistent answers compared to previous years (81.3%). EKGs were also reviewed and none met criteria for further testing.

Conclusions: Our study shows a lower than desired positive predictive value for the AHA PPE questionnaire. We had a false positive rate of 71.9% thus decreasing our ability to use the questionnaire to accurately predict the risk for developing cardiovascular events and isolate individuals for further testing. Our study also shows a high rate of inconsistent question answering raising concern for reliability.

Significance: The significance of this study is to improve the PPE cardiac screening in student athletes at our institution by improving questionnaire administration in order to increase sensitivity and specificity of screening tools.

Acknowledgments: Supported by University Hospital and Clinics, University of Louisiana at Lafayette, and Louisiana State University Health Science Center.

TOPIC: Epidemiology

STUDY: Case-Control

Genetic Predisposition to Glenohumeral Osteoarthritis: Case & Control Identification for Future Genome-Wide Association Study

Primary Author/Presenter: Alan Grusky, MD

James Gardner, MD, Carsen Cash, MD, Margaret Ruthford, BSPH, Stephen Schaaf, MD, and Nitin Jain, MD, MSPH
Affiliation: University of California, Los Angeles (UCLA), Los Angeles, California.

Purpose: To identify genetic predisposition to glenohumeral osteoarthritis by (1) classifying x-ray-verified cases/controls using de-identified electronic health records (EHR) and (2) performing a genome-wide association study (GWAS) to identify single nucleotide polymorphisms associated with the disease.

Methods: Case-control and GWAS. Data obtained from the Vanderbilt University Synthetic Derivative and BioVU, a novel de-identified EHR linked to a genetic repository. Patient records with age 40+ years old, ICD codes indicating shoulder x-ray was performed, and records with genotyped DNA were reviewed and classified into cases versus controls based upon imaging documentation of glenohumeral osteoarthritis.

Results: The algorithm yielded $n = 7687$ patient records. Of these records, $n = 1401$ (18%) records were excluded, $n = 5007$ (65%) were identified as cases, and $n = 1279$ (16%) were identified as controls. The sample was 54% female. The ethnic distribution was 83% Caucasian, 14% Black, 3% from Asian, Hispanic, Native American, or others. The age distribution was skewed heavily toward those greater than 65 years old. In addition, data was collected on the reported severity of glenohumeral osteoarthritis cases. "Mild" GH OA was reported in $n = 573$ cases (34%), "Moderate" GH OA was reported in $n = 266$ cases (16%), and "Severe" GH OA was reported in $n = 530$ cases (31%). The remaining cases did not explicitly report severity of disease.

Conclusions: The current results have demonstrated that our established protocol using a novel biorepository is able to efficiently, accurately, and inexpensively classify x-ray-verified cases and controls for glenohumeral osteoarthritis. These cases and controls will be used to conduct a GWAS of necessary power that will allow us to identify single nucleotide polymorphisms associated with glenohumeral osteoarthritis.

Significance: Successful classification of GH OA cases/controls with impending GWAS demonstrates immense potential of this study method. It allows for enhanced understanding of genetic underpinnings of disease that can be applied to conditions even beyond GH OA.

Acknowledgments: Thank you to my study mentors, Dr Stephen Schaaf and Dr Nitin Jain.

TOPIC: Other

STUDY: Other

Improving Healthcare Access for Collegiate Athletes

Primary Author/Presenter: Josh Hansen, MD

Cates Bo, DO, Clark Madsen, MD, and Stephen Scharmann, MD

Affiliation: McKay Dee Family Medicine Residency.

Purpose: Weber State University has an estimated 400 non-NCAA athletes competing in cheerleading, dance, and club sports. These athletes have typically been without physician or athletic trainer (AT) coverage. This is a quality improvement and proof of concept project to increase their access to healthcare.

Methods: A weekly free MSK clinic was created at an on campus athletic training room. Emails were sent to appropriate athletes to inform about the clinic. Athletes contacted an AT to schedule into clinic. Clinic was staffed by an AT and family medicine resident. Data was collected over a 2 year period for each clinic visit including injury, imaging, referrals, treatments, and potential CPT billing code.

Results: For the first several months the clinic averaged about 4 athletes per half day clinic. This increased steadily to 7 athletes per clinic during the second year of data collection. Clinic visit numbers continued to grow throughout the project, but did on weeks with university holidays or breaks. 50% of visits would have been billed a level 4, the others a level 3. About 15% of clinic visits resulted in an x-ray, 20% in an MRI, and 13% in physical therapy orders. Sixteen athletes were referred for surgical evaluation and 2 underwent PRP treatment.

Conclusions: This project showed that a weekly free half-day MSK clinic for club and other high level non-NCAA athletes can be filled. A large percentage of the clinic visits results in imaging, physical therapy, or surgical referrals. Half of the visits could have been billed at a level 4 due to severity and complexity of the athletes injuries. Surgeries and other treatments that may have gone elsewhere stayed within the physician group.

Significance: This clinic created access for these athletes to an MSK provider. There is significant financial benefit to providers and a healthcare group to justify the time spent at the clinic. Traditional billing within the clinic could increase its viability.

Acknowledgments: McKay Dee Family Medicine Residency, Clark Madsen, Stephen Scharmann, Bo Cates, and Breanna Cutler.

TOPIC: COVID

Increased Injury Rate After COVID-19 Infection in Elite US Youth Soccer Players

Primary Author/Presenter: Brian Harvey, DO

Johnathan Warren, MD, Kyle Broughman, MD, Shannon Margherio, PT, OCS, James Roberson, MD, and Kevin Latz, MD

Affiliation: Children's Mercy Hospital—Kansas City, Kansas City, Missouri.

Purpose: To the best of our knowledge, there is no data on the effects that COVID infection has on elite youth soccer athletes in the United States. Therefore, our purpose is to determine the risk of injury after a COVID infection in youth soccer athletes at a developmental academy.

Methods: Soccer injuries for local developmental academy teams U12 (12 years and under)-U19 (19 years and under) were reviewed. Data from the Spring 2022 season was analyzed after an outbreak within our teams. Injury rate in athletes who were COVID positive was compared to injury rate in those same athletes during Fall 2021. Athletes were documented as COVID positive after a positive rapid test.

Results: Compared to their Fall 2021 season, COVID-infected athletes sustained significantly more injuries after infection in Spring 2022 (0.58 plus minus 0.82 vs 1.37 plus minus 0.58, P less than 0.001). During the Spring 2022 season, there were 67 injuries (50%) and 33 athletes (24.6%) who tested positive for COVID. Twenty (60.6%) COVID positive athletes sustained an injury between February and July 2022. The odds ratio and relative risk for injury in COVID positive athletes during the Spring 2022 season was 3.3 (CI: 1.53-7.13) and 1.67 (CI: 1.23-2.26), respectively. COVID positive athletes on the U19 team had an injury rate of 12/1000 hours versus 9.5/1000 hours in COVID negative athletes. For the U17 team, COVID positive athletes had an injury rate of 10.5/1000 hours compared to 5.7/1000 hours in COVID negative athletes. Other injury rates were similar. There were no significant differences in injury type or location between COVID positive and COVID negative athletes.

Conclusions: Among elite youth soccer athletes in the United States, injury rate increased significantly after COVID infection, resulting in over twice as many injuries. Injury patterns between COVID positive and negative athletes were not significantly different. This data suggests that COVID infection increases the risk of injury and caution should be exercised in returning elite youth soccer athletes to play.

Significance: Given the continuing burden of COVID, preventive strategies must be revised as current return to play processes were not successful in alleviating injuries in these athletes after COVID infection.

Acknowledgments: Kurt Andrews.

TOPIC: Musculoskeletal

STUDY: Cohort

Non-Bracing Treatment of Isthmic Spondylolysis, Grade I/II Spondylolisthesis in Persons 7-25 Years

Primary Author/Presenter: William Hollabaugh, MD

Holly Harper, MD, Hui Nian, PhD, and Andrew Gregory, MD

Affiliation: Division of Sports Medicine, Vanderbilt Department of Orthopedics, Vanderbilt University Medical Center, Nashville, Tennessee.

Purpose: Recent studies displayed no difference in treatment success between bracing and non-bracing management of isthmic spondylolysis (spondy) and spondylolisthesis (listhesis). This study assessed the efficacy of bracing versus non-bracing management of spondy and listhesis in patients 7 to 25 years old.

Methods: Retrospective cohort study of patients 7 to 25 years old who presented to our institution from January 1, 2018 to January 1, 2021 and were diagnosed with spondy or grade I listhesis or grade II listhesis and were treated with bracing or non-bracing management. Individuals were excluded if they had prior diagnosis of spondy or listhesis, had prior spinal surgery or were classified as non-isthmic.

Results: One hundred forty-one patients (14.5 ± 3.4 years, 48.2% female). Spinal diagnosis was 48.2% G1, 46.8% spondy, 5.0% G2. 13.8% of patients were treated with bracing—soft corset (44.4%), rigid orthosis (33.3%), unspecified type (22.2%). Median bracing duration was 54.8 ± 19.6 days (range: 42-90 days). 46.1% (65/141) of patients had a reported outcome—96.4% (54/56) of non-braced patients

returned to play (RTP) and 77.8% (7/9) of braced patients RTP ($P = 0.16$). Median RTP was 70 days (range: 0-363 days). There was no difference of adverse event (back pain reoccurrence, slip progression, surgery) between non-bracing versus bracing treatment ($P = 0.21$). Multivariable cox proportional hazard model did not show a statistically significant effect of bracing, gender, race, sport, diagnosis, or spinal level on RTP. Multivariable proportional odds ordinal logistic regression did not show a statistically significant effect of bracing, age, gender, sport, diagnosis, or spinal level on adverse event.

Conclusions: In this study, there was no statistically significant effect of gender, race, sport, diagnosis, or spinal level on RTP and there was no statistically significant effect of age, gender, sport, diagnosis, or spinal level on adverse event. Furthermore, there was no statistically significant difference between bracing versus non-bracing treatment regarding risk of adverse event or RTP timing.

Significance: Compared to bracing, our findings support recent evidence that non-bracing treatment of spondy and listhesis is both safe and effective. Use of bracing versus non-bracing management of spondy and listhesis must be tailored to the individual patient.

Acknowledgments: Vanderbilt University Medical Center Research Derivative.

TOPIC: Education

STUDY: Other

The Top 100 Sports Medicine Influencers on Twitter

Primary Author/Presenter: Conner Howard, BS

Ryan McIntire, BS, J. Michael Anderson, DO, Carter Stewart, BS, Haddon McIntosh, BS, James Cornwell, DO, Kim Barron, DO, and Jake Checketts, DO

Affiliation: Oklahoma State University Center for Health Sciences.

Purpose: With an increasing amount of sports medicine content on social media, it is important to identify the individuals leading discussions. The purpose of this study was to identify the top 100 Twitter influencers in sports medicine.

Methods: Twitter influence scores for “sports medicine” were collected in November 2021 from Right Relevance. The accounts with the top scores were screened in a double-blind duplicate manner for occupation, location, practice setting, h-index, level of athletics, related sports, and Twitter profile characteristics.

Results: Of the top 100 sports medicine influencers on Twitter, 48% were identified as physical therapists. The U.S.A. and the U.K. represent the most frequent locations. The mean h-index was 30.2 (95% CI = [24.8-35.6]) with a median of 22.0 (range = 1-101). Most individuals reported multiple practice settings (63%), with an academic setting as the most common (60%). Level of athletic involvement was identified for 71 influencers, with professional (62%) and Olympic levels (49%) as the most common. Related sports were identified for 64 individuals, with soccer (48%) and rugby (30%) as the most frequently reported. Seventy-six individuals had URLs in their Twitter biographies, with most URLs linked to personal websites (57.9%).

Conclusions: Sports medicine discourse on Twitter is led by accredited sports medicine specialists from a variety of occupations, locations, and clinical backgrounds. Future research may aim at analyzing the content within sports

medicine influencers' tweets, which may further establish credibility regarding the content disseminated.

Significance: The relatively high h-index in this study suggests sports medicine influencers on Twitter are notable contributors to academic literature. This study also provides the top influencer network for sports medicine clinicians to interact with on Twitter.

Acknowledgments: The authors would like to thank Vishal Mishra and his team at Right Relevance, Inc. (www.right-relevance.com, Cronycle, San Francisco, U.S.A.) for providing the relevant topical influencers report used for this study.

TOPIC: Other

STUDY: Other

Return to Golf Following Hip Arthroscopy—A Systematic Review of the Literature

Primary Author/Presenter: Conner Howard, BS

Jake Checketts, DO, Olivia Panchal, MS, Joshua Stephens, BS, Amar Patel, DO, Tyler Hunt, BS, Arjun Reddy, BA, and Chad Hanson, DO

Affiliation: Oklahoma State University Center for Health Sciences.

Purpose: The purpose of this study was to review the current literature on return to play data following hip arthroscopy, and secondly, provide data to practitioners so that they can set proper expectations with their patient.

Methods: We conducted a systematic review of literature related to hip arthroscopy in golfers. Articles were considered for inclusion if they were level I to IV evidence. A search in November, 2021, using Pubmed and Embase as our electronic databases, was conducted. For our inclusion criteria, we included any study that contained patient specific data for golfers undergoing hip arthroscopy.

Results: Following our comprehensive search of multiple databases, a total of 400 records were returned. After inclusion and exclusion criterias were applied, a total of 4 studies were included for final analysis. 90 of 95 (94.7%) golfers studied successfully returned to golf after arthroscopic hip surgery. It took 4.7 months for professional golfers, and 7.2 months for amateur golfers to return to sport. Subjective and objective outcome scores improved post-operatively, including an increased mean drive distance.

Conclusions: In conclusion, our review of the literature demonstrates that a return to golf following hip arthroscopy is probable with over 95% of patients in the literature returning to play. Furthermore, patients returned at means of 4.2 and 7.2 months indicating a relatively quick return to the course.

Significance: Our study provides information and data that can be shared with patients regarding their expected clinical course following hip arthroscopy if they wish to return to golf.

TOPIC: Pediatrics

STUDY: Cohort

Trends in Pediatric Sports Medicine Patients Presenting With Musculoskeletal Injuries During the COVID-19 Pandemic in Florida

Primary Author/Presenter: Hilary Howard, DO

Kyle Mihaylo, MD, Danielle Ransom, PsyD, James Toldi, DO, Sarah Irani, MD, and P. Patrick Mularoni, MD

Affiliation: Bayfront Health St. Petersburg, St. Petersburg, Florida.

Purpose: COVID-19 pandemic restrictions impacted global sport participation, injury rates, and healthcare utilization. State-specific trends are not yet known. We sought to characterize trends in pediatric musculoskeletal injuries in Florida, where competition resumed in August 2020.

Methods: Demographic and injury-related characteristics were extracted as part of a retrospective chart review of pediatric patients aged 5 to 21 treated for musculoskeletal injury in a sports medicine specialty clinic within a quaternary pediatric healthcare setting. Subjects were included if initial encounter occurred during 2019 (Pre-Pandemic cohort) and 2020 (Pandemic cohort) fall sport seasons.

Results: Fewer patients presented with new musculoskeletal injuries in the Pandemic cohort ($n = 102$) compared with the Pre-Pandemic cohort ($n = 139$). Results of t -tests and χ^2 analyses did not identify statistically significant group differences in most demographics, including age, sex, and Child Opportunity Index (all P s > 0.05). Analyses exploring race/ethnicity indicated significant differences between cohorts, with more subjects opting not to report race/ethnicity in the Pandemic Cohort compared with the Pre-Pandemic cohort ($P < 0.01$). In addition, there was a significant increase in the number of uninsured patients in the Pandemic cohort compared with the Pre-Pandemic cohort ($P < 0.05$). There were no significant group differences in injury mechanism, days from injury to initial clinic encounter, type of injury, or injury setting/activity (all P s > 0.05).

Conclusions: No significant differences in pediatric musculoskeletal injury characteristics were observed after lifting statewide COVID-19 restrictions, indicating that a prolonged period without organized sport did not lead to different injury patterns. Although demographics were largely unchanged, significantly more new patients did not have insurance in the Pandemic cohort compared to the Pre-Pandemic cohort, consistent with known socioeconomic trends.

Significance: The effects of the global COVID-19 pandemic continue to be explored. This study aimed to characterize trends in pediatric musculoskeletal injuries in a state with a relatively brief period of restricted sport participation.

Acknowledgments: Research assistant for this project: Katelyn Heinz, ATC.

TOPIC: Musculoskeletal

STUDY: Survey

Functional Outcomes of Extracorporeal Shockwave Therapy on Patients Evaluated Through Telehealth During the COVID-19 Pandemic

Primary Author/Presenter: Connie Hsu, MD

Marissa Eckley, MD and Adam Tenforde, MD

Affiliation: Harvard Spaulding Rehabilitation Hospital, Charlestown, Massachusetts.

Purpose: The goal of this study was to evaluate functional outcomes for sports medicine patients treated with extracorporeal shockwave therapy (ESWT) for musculoskeletal conditions who were initially evaluated for this intervention through telehealth during the COVID-19 pandemic.

Methods: New patients evaluated in sports medicine clinic through telehealth from March 2020 to July 2020 for various musculoskeletal diagnoses who were treated with ESWT were included in the study. All patients filled out functional measures (VISA, FAAM, or QUICKDASH) at initiation and following treatment with ESWT. All were prescribed or advised on an exercise program specific to the condition treated.

Results: The total sample was comprised of 30 patients (60% female, 40% male) with an average age of 44 years. Patients received an average of 4.9 ESWT sessions. Patients' demographics (age, height, and weight) were not significantly associated with change in functional outcome scores. Overall, 22 of the patients treated with ESWT demonstrated improvement in functional outcome scores with an average improvement of 9.5 points (out of 100) and 13 out of 30 patients meeting a minimum clinically important difference (MCID) for their respective diagnoses. T-test analysis conducted on the change in functional scores demonstrated that the improvement in outcomes was statistically significant ($t = 3.82$, $df = 29$, $P < 0.001$).

Conclusions: The widespread use of telehealth during and after the COVID-19 pandemic has been unprecedented, and the effects on health care delivery and patient outcomes has not yet been well investigated. This study concluded that patients evaluated through telehealth for extracorporeal shockwave therapy demonstrated significant improvement in their functional outcomes after treatment.

Significance: Although further studies will be required to determine the effect of telehealth evaluations for treatment of musculoskeletal conditions, the results of this study are promising.

Acknowledgments: I would like to thank Dr Tenforde for his mentorship and guidance through this project and as an outstanding leader in the field of sports medicine.

TOPIC: Other

STUDY: Survey

Motivation and Influential Factors Affecting Female Athlete Participation in Organized Athletics

Primary Author/Presenter: Richard Jarvis III, BA

Emily Demaio, MD, Jennifer London, MS, LAT, ATC, Christie Chen, MD, and Courtney Gleason, MD

Affiliation: Emory University School of Medicine, Atlanta, Georgia.

Purpose: To better understand the factors influencing athletic habits of adolescent females in a middle-income southern metropolitan edit community and their decisions to continue to participate in and/or withdraw from organized athletics.

Methods: Female candidates ages 12 to 19 were recruited from Emory Sports Medicine Clinics. Eligible subjects completed an 18-question survey detailing their current level of athletic involvement including the number of sports played, overall time committed to sports, athletic competency, sports that they have quit, and factors motivating them to continue or discontinue participation in each of their sport.

Results: This study enrolled 73 females (mean age of 15.9 + 1.9 years, min 12.0, max 19.0). Participants reported playing an average of 13.1 total hours (min 0.0, max 40.0, STDV 8.1) of organized sports each week (excluding gym/PE/non-organized activities). Thirty (42.25%) athletes indicated quitting a sport in the previous 24 months. Volleyball and cheerleading had the highest dropout rates (40%) followed by Track (30.8%), Cross Country (20.0%), Soccer (15.4%), and Basketball (15.4%). The highest quit rate was observed in participants reporting moderate sport competency (21.6%). In the population of participants whose parents do not play sports, 3 (21.43%) reported quitting a sport while 27 (48.21%) of participants with exercising parents reported quitting a sport

in the past 24 months. In the population of participants whose siblings exercised, 24 (45.3%) reported quitting a sport and 5 (41.67%) participants without exercising siblings reported quitting a sport in the past 24 months.

Conclusions: In this population, staying in shape, having fun and improving skill are the most valued athletic goals while pleasing parents, pleasing coaches, and prospective financial gain were valued the least. Top reasons for quitting a sport were: focus on a different sport, time constraints, and insurmountable injury. Further research is necessary to produce accurate and intricate causal relationships between attrition rates and these results.

Significance: This report is a preliminary step in improving women's health and wellness along with furthering the support of young female athletes. Exploration of these trends can help our community to better encourage life-long healthy habits in young women.

Acknowledgments: The authors thank Neeta Shenvi and Kirk Easley of the Emory Biostatistics and Bioinformatics team and Rollins School of Public Health for their data analysis and figures. The authors also thank Emma Cronk MD for contributing to ideas for survey question

TOPIC: Running

Big-Five Personality Dimensions in Ultramarathon Runners: Findings of the Ultrarunner Longitudinal T

Primary Author/Presenter: James Jastifer, MD

Affiliation: Department of Orthopedic Surgery, Ascension Borgess Hospital, Homer Stryker M.D. School of Medicine, Western Michigan University, Kalamazoo, Michigan.

Purpose: The psychological aspect of ultrarunning is of interest in sports medicine. Ultrarunners are described as mentally tough, and have been shown in studies to be goal oriented, and intrinsically motivated. It is unknown how the personality traits of this group compare to the general population.

Methods: The Ultrarunner Longitudinal TRACking Study (ULTRA Study) is the largest known longitudinal study of ultramarathon runners. Questions on general health status, running behavior and performance, as well as the validated Ten-Item Personality Inventory of the Big-five personality dimensions was administered.

Results: Six hundred fifty-eight ultramarathon runners completed the inventory. Ultramarathon runners score statistically significantly lower in extroversion (3.73 vs 4.44, $P < 0.0001$), and agreeableness (5.08 vs 5.23, $P = 0.0099$) compared to a control population. They scored higher in conscientiousness (5.94 vs 5.4, $P < 0.0001$), and emotional stability (5.28 vs 4.83, $P < 0.0001$), while statistically similar in openness to experiences (5.34 vs 5.38, $P = 0.4174$).

Conclusions: The current study dimensions of relatively low agreeableness (competitive), and extroversion (able to stay within oneself), combined with relatively high conscientiousness (organized, goal-directed), and emotional stability (stable in stressful circumstance), quantify the differences between a large ultramarathon runner population and a control group.

Significance: This study represents the largest known study of ultrarunners and the Big-five personality dimensions for this group. This data informs sports medicine providers on the underlying personality dimensions that may be more common of this group.

TOPIC: Other
STUDY: Cohort

Does Implementation of Patient Health Questionnaire Increase Referrals to Behavioral Health Services

Primary Author/Presenter: Sanjiv Kandiah, MD

Rachel Chamberlain, MD, CAQSM

Affiliation: The University of New Mexico, Albuquerque, New Mexico.

Purpose: NCAA student-athletes are at risk of depression. Patient Health Questionnaire (PHQ) is a validated screening tool for depression. The purpose of this study is to analyze if the implementation of the PHQ resulted in increased referrals for behavioral health intervention among student-athletes.

Methods: In May of 2020, PHQ was administered to student-athletes who were seen at the University of New Mexico training room clinic. Those who were identified with symptoms of depression by the physician were referred to see behavioral health services. The number of referrals made 1 year before the PHQ implementation were compared to those made 1 year after.

Results: PHQ implementation in May of 2020 has resulted in increased referrals to behavioral health services among student-athletes. In comparison to the year before, this is a significant increase.

Conclusions: In conclusion, the implementation of PHQ 9 has resulted in increased referrals to behavioral health services in comparison to the year before. There are a few confounding variables. These include the COVID-19 pandemic, other avenues of referrals (i.e., coaching staff and athletic trainers) and known stigmatization of admitting to mental health problems among athletes.

Significance: Patient Health Questionnaire (PHQ) is a simple and cost-effective validated screening intervention that can help identify student-athletes with depression or depression related symptoms so that appropriate mental health referrals can be made.

Acknowledgments: We would like to thank the medical staff for administering the PHQ questionnaires and to the athletic training staff and mental health providers for their teamwork in providing holistic care to our athletes.

TOPIC: Epidemiology

STUDY: Cohort

The Epidemiology of Injuries and Illness on a Professional Ice Hockey Team After SARS-COV-2, A Retrospective Review

Primary Author/Presenter: Christian Kaschak, DO

Jolie Holschen, MD

Affiliation: Loyola University Medical Center, Chicago, Illinois.

Purpose: While there are few studies evaluating injury and illness in the American Hockey League, no studies have analyzed the effects of the SARS-CoV-2 pandemic. This study reports the epidemiology and cost of injury and illness on an AHL team in the year after the introduction of SARS-CoV-2.

Methods: This was a retrospective cohort study of an AHL team during the 2021 to 2022 season. Data was extracted from daily injury and illness reports and the electronic medical record. Team and league protocols aimed at surveillance,

testing, and mitigating the risk of contracting and disseminating SARS-CoV-2 were reviewed and cost assessed. Injuries and illness were categorized and days missed calculated.

Results: We identified 160 discrete injuries and 56 illnesses leading to 1028 and 260 days missed, respectively, among 50 athletes. The average number of days missed for an injury was 6.43 compared to 4.64 for an illness. The most common injury was contusion, occurring 63 times (39.38% of injuries) leading to 175 days missed (average 2.78 days each). Other injuries included tightness (13.13%), strains (11.25%), lacerations (8.13%), sprains (8.13%), concussion (3.13%), fracture (1.88%), dental injury (1.88%), and lumbar disc herniation (1.88%). Lumbar disc herniation caused the most missed time due to injury with 340 days missed (33.07% of total), averaging 113.33 days per injury. The shoulder was the second most commonly injured region. SARS-CoV-2 was the most prevalent illness, afflicting 24 of 50 athletes, and also the leading illness to cause time missed, resulting in 182 days missed (average 7.58 days each), primarily a result of league protocols requiring arbitrary isolation and testing.

Conclusions: Injuries to the back and shoulder resulted in the majority of time missed due to injury. SARS-CoV-2 protocols in place at the time resulted in costly surveillance testing, unremarkable and costly subsequent cardiac screening and clearance, and excessive time missed from sport. There were no complications associated with SARS-CoV-2 infection among these elite athletes.

Significance: These results have implications for injury prevention research in ice hockey, focusing on the back and shoulder. SARS-CoV-2 protocols should account for the high cost of implementation and low incidence of infection-associated complications.

TOPIC: Concussion

STUDY: Other

Video Signs of Concussion in a Division One Football Team

Primary Author/Presenter: Jeremy Kent, MD

Alexander Martin, MD, Emmelyn Luu, MD, Sarah Blackstone, PhD, and John MacKnight, MD

Affiliation: University of Virginia.

Purpose: Identifying in-game sport-related concussions can be a difficult task. Video signs of concussion has been studied as a tool to help identify SRCs sooner during gameplay. The purpose of this study is to provide an objective calculation of concussion video signs in NCAA American football.

Methods: This retrospective epidemiological study used game play video from an NCAA division 1 football team during the seasons 2010 to 2020 to analyze diagnosed SRCs. Three authors reviewed the video to identify video signs of concussion. The SRCs we investigated were those that we defined as being with the primary ball handler or primary tackler.

Results: Over the course of 11 seasons, there were 30 games in which at least one SRC occurred. Of those 30 games, 33 SRCs met our inclusion criteria. Each reviewer reviewed 2220 plays from those 30 games. The most common video sign was hand to helmet. The second most common was slow to get up. The sensitivity, specificity, positive predictive value and negative predictive value for all video signs of concussion were 10.2%, 99.3%, 66.7% and 88.7% respectively. The interrater reliability for video signs based on the consensus statement guidelines 9 was 0.693 kappa (CI 0.671-0.715).

Conclusions: The results in this study show that having a video sign is a reliable method to rule in a concussion but does not provide much information to help rule it out. This study utilized a novel means to calculate the cross tabulation of video signs of concussion by only investigating the primary ball handler/tackler. We present this as a more accurate way to investigate the impact of video signs of concussion.

Significance: This study is one of the first to detail video signs of a concussion in college level athletes. It also utilized a novel means to calculate a concussion based on ball location and we argue it is a more objective measure to compare video signs of SRCs.

TOPIC: Other

STUDY: Survey

Specialization Histories and Mechanical Changes in Developing Baseball Pitchers From the Pitch Efficiency Rating Database

Primary Author/Presenter: Charles Kenyon, DO, MS, CSCS
Mario Martinez, Neeru Jayanthi, MD, and Robert Bowers, DO, PhD

Affiliation: Emory Sports Medicine, Atlanta, Georgia.

Purpose: Young developing baseball athletes are at increased risk of injury due to pressures of early specialization, high training volumes, and potential mechanical inefficiencies in the throwing motion. This study aims to describe these risk factors in this vulnerable athlete population.

Methods: The present study utilized a retrospective survey with cross-sectional pitching analysis at the start of the spring season in male baseball athletes 11 to 23 years old. A previously validated Pitch Efficiency Rating (PER) was applied to quantify the relative efficiency of the pitching motion. Descriptive analysis was performed to assess the presence of known injury risk factors in throwing athletes.

Results: Athletes were grouped based on level of competition [youth (Y), high-school (HS) and college (Col)]. Sixty-one athletes participated in video PER analysis, and 41 responded to the pre-season survey. Athletes reported starting organized baseball at an average of 5.5 y/o, and pitching at 9.5 y/o. Those specializing in baseball-only did so at 12.8 y/o, with those focusing on pitching-only at 15.7 y/o. Athletes reported playing for an average of 2.1 teams at both the Y and HS levels, and 1.4 teams for Col pitchers. Athletes participated in baseball training or competition an average of 9.1, 9.8, and 10.2 mo/yr at the Y, HS, and Col levels respectively. Similarly, athletes trained 9.0, 13.5, and 20.7 h/wk at their respective levels. PER analysis demonstrated a trend towards more efficient mechanics at higher levels of competition with average PER scores of 23.8/36 (range 23-25) in Y athletes, 24.1/36 in HS athletes (range 20-31), and 25.4/36 (range 22-30) in Col athletes.

Conclusions: The majority of athletes surveyed at all levels of competition met criteria for moderate to high levels of sports specialization, even at the youth level. Athletes generally reported training less hours per week than their age, however most endorsed training year-round in baseball as their primary sport (>8 mo/yr). PER analysis demonstrated increased mechanical efficiency with higher levels of competition at the Y, HS, and Col levels.

Significance: This data provides insight for counseling throwers. Most athletes reported specialization histories indicating increased risk of injury. PER is a practical tool for mechanical evaluation and may categorize changes through a pitcher's development.

Acknowledgments: Ben King, Georgia Tech Baseball, Marshal Dreyer, ATC, Cherokee Bluffs High School, Chris Carruth, ATC, West Hall High School.

TOPIC: Concussion

STUDY: Cohort

Does Post-Injury Balance Measurement Improve Diagnostic Accuracy of Sports-Related Concussions When Compared to Baseline?

Primary Author/Presenter: Hamish Kerr, MD, MSc, FAMSSM

Ashar Ata, MBBS, MPH, PhD, Dwyer Madison, BS, Bowen Michelle, ATC, and Bowen Brady, DO

Affiliation: Albany Medical College, Albany, New York.

Purpose: To retrospectively determine if the Equilibrate System (balance determination by force plate & motion analysis) provide an improved dichotomy between baseline and post-injury values that correlate with individuals diagnosed with SRC compared to computerized neuropsychological testing.

Methods: We identified 61 athletes with baseline ImPACT and Equilibrate through chart review from 2012 to 2022 of Albany Med Sports Medicine. 17 athletes met the inclusion criteria for playing a sport, diagnosis with SRC, and both baseline and post-injury scores for ImPACT and Equilibrate. The scores for ImPACT and Equilibrate data were analyzed through paired *t*-tests comparing baseline to post-injury.

Results: When measuring balance with Equilibrate, the Right Foot Forward Eyes Open position score decreased significantly post-injury as compared to baseline by an average of 7.1 units (95% CI: 0.7, 13.6, $P = 0.0325$). Based on ImPACT, the symptom score increased significantly post-injury compared to baseline with a mean increase of 16.1 units (95% CI: 8.1, 24.1, $P = 0.0004$). None of the remaining post-injury ImPACT parameters were statistically different from baseline. Decreases were noted among all other Equilibrate positions including double leg stance (eyes open/closed), single leg stance (right and left, eyes open/closed), and tandem stance (left foot forward, eyes open/closed and right foot forward, eyes closed) though these did not reach statistical significance.

Conclusions: Our data demonstrates that the symptom score from the ImPACT and Equilibrate score for right foot forward tandem stance with eyes open are effective in diagnosing SRC, when comparing athlete scores from baseline to post-injury. The Equilibrate System has potential to serve as a precise tool for SRC diagnosis due to its objective nature and higher sensitivity to document subtle differences in sway movements not visible to the naked eye.

Significance: Variability of severity with SRC contributes to difficulty determining when they are recovered from the diagnosis. The effectiveness of balance for post-injury testing was a greater discriminant than computerized neuropsych testing in this study.

TOPIC: Other

STUDY: Other

Declining Inflation-Adjusted Medicare Physician Fees: An Unsustainable Trend in Hip Arthroscopy

Primary Author/Presenter: Andrew Kim, BA

Adam Rizk, BA, Jason Ina, MD, Steven Magister, MD, Robert Flannery, MD, and Michael Salata, MD

Affiliation: Department of Orthopaedic Surgery and Sports Medicine, University Hospitals Cleveland Medical Center, Cleveland, Ohio.

Purpose: Although hip arthroscopy continues to be one of the most utilized arthroscopic procedures, no formal evaluation of reimbursement trends has been conducted. The purpose of this present study is to analyze the temporal Medicare reimbursement trends for hip arthroscopy procedures.

Methods: From 2011 to 2021, the Medicare Physician Fee Schedule Look-Up Tool was queried for Current Procedural Terminology codes related to hip arthroscopy (29860-29863, 29914-29916). All monetary data was adjusted to 2021 United States dollars. The compound annual growth rate and total percentage change were calculated. Mann-Kendall trend tests were used to evaluate the reimbursement trends.

Results: Based on the unadjusted values, a significant increase in physician fee was observed from 2011 to 2021 for CPT codes 29861 (removal of loose or foreign bodies; % change: 3.49, $P = 0.03$) and 29862 (chondroplasty, abrasion arthroplasty, labral resection; % change: 3.19, $P = 0.03$). The remaining CPT codes experienced no significant changes in reimbursement based on the unadjusted values. After adjusting for inflation, all 7 of the hip arthroscopy CPT codes were observed to experience a significant decline in Medicare reimbursement. Hip arthroscopy with acetabuloplasty (CPT: 29915) and labral repair (CPT: 29916) exhibited the greatest reduction in reimbursement with a decrease in physician fee of 24.69% ($P < 0.001$) and 24.64% ($P < 0.001$), respectively over the study period.

Conclusions: Medicare reimbursement for all 7 of the commonly used hip arthroscopy services did not keep up with inflation, demonstrating marked reductions from 2011 to 2021. Consequently, orthopedic surgeons could be disincentivized from performing necessary hip arthroscopy services, limiting access to high-quality hip arthroscopic care. Out-of-network or uninsured patients may also experience surprise billing due to the declining Medicare reimbursement.

Significance: With the projected increase in hip arthroscopy volume, a better understanding of Medicare physician fee trends and the current economic climate around hip arthroscopy is necessary to promote equitable access and reduce financial burden for patients.

TOPIC: Nutrition STUDY:

Relationship Between Body Image Drives, Disordered Eating and Race in High School Athletes

Primary Author/Presenter: Jessica Knapp, DO
Rachel Buchanan, MD

Affiliation: MAHEC, Asheville, North Carolina.

Purpose: The purpose of our study was to determine the relationship between race and disordered eating (DE) and clinical eating disorder (ED) measured by Female Athlete Screening Tool (FAST), drive for thinness (DT), drive for leanness (DL), and drive for muscularity (DM) in female high school (HS) athletes.

Methods: Observational cross-sectional survey of female student-athletes at 2 HS for DL, DM, DT, ED, DE. For categorical variable pairs (race and categorical outcomes DE, DT), χ^2 analysis was performed. Logistic regression was performed on dichotomized DE and DT. For DL and DM, linear regression was performed. Regression models were analyzed with dichotomous race and continuous age as predictors.

Results: A total of 60 HS participants completed surveys. Nineteen (32%) of HS participants met criteria for ED or DE. Thirty-five HS athletes (58%) identified as a person of color. The age of white athletes averaged 15.2 years, and athletes of color averaged 15.4 years. No significant relationship was found between race and ED or DE for female HS athletes, including when controlling for age. In addition, no significant relationship was found between race and DT, DL, or DM for female HS athletes, including when controlling for age.

Conclusions: Race does not appear to be a protective factor or a risk factor in the development of disordered eating, nor does it appear that DT, DL, or DM varies by race. The finding that 32% of the sample showed ED or DE behavior is consistent with prior literature on disordered eating rates in female athletes.

Significance: These findings highlight the need for effective ED and DE mass screening and programs in all female high school athletes.

Acknowledgments: AMSSM for young investigator grant.

TOPIC: Other

STUDY: Survey

Awareness of Medical Problems That Affect Female Athletes Among Coaches and its Gender Differences

Primary Author/Presenter: Yuka Kodama, MD, PhD

Suguru Torii, MD, PhD, Hiroshi Kamada, MD, PhD, and Fumihiro Yamasawa, MD, PhD

Affiliation: Tokyo Women's College of Physical Education, Tokyo, Japan.

Purpose: Track and field is a multievent sport and thus, there is potential for a wide range of injuries and illnesses and such knowledge keeps athletes healthy and enhances their performance. Knowledge of medical problems affecting female athletes among track and field coaches.

Methods: Track and field coaches (369 men and 43 women) completed an anonymous survey on their knowledge of medical problems pertinent to female athletes. In addition, coaches were asked about their opinion on female athletes' use of contraceptive pills; whether they speak about menses with the female athletes; and whether they have a gynecologist for consultation regarding their medical problems.

Results: Female gender was positively related to these outcomes in logistic regression analysis and female coaches were significantly more likely to be aware of the triad [odds ratio (OR), 3.44; $P = 0.003$]; to have access to a physician able to address the gynecological problems of female athletes (OR, 9.22; $P < 0.001$); and to talk to their female athletes about menses (OR, 2.30; $P = 0.015$) than their male counterparts (all $P < 0.05$). Coaches with more experience tended to be aware of the triad and relative energy deficiency in sports compared with those with ≤ 5 years of experience.

Conclusions: Female coaches were more knowledgeable about the medical problems that affect female athletes. In addition, more female than male coaches talk about menses with their female athletes, and have access to a physician who can address gynecological problems.

Significance: The results above are suggesting that the need for more female coaches is high. Educating all coaches on these problems is essential to provide adequate support to female athletes.

Acknowledgments: We thank all the coaches who complete the survey.

TOPIC: Epidemiology

STUDY: Other

Epidemiology of Wrist Fractures at a Colorado Ski Resort

Primary Author/Presenter: Jennifer Kordell, MD

Jennifer Cogburn, MD, Corey Ho, MD, Lauren Pierpoint, PhD, Jack Spittler, MD, and Morteza Khodae, MD, MPH

Affiliation: Department of Family Medicine, University of Colorado School of Medicine, Denver, Colorado.

Purpose: Wrist fractures are a common upper extremity injury among winter sports participants. The purpose of this study is to evaluate the demographics and wrist fracture injury characteristics among patients evaluated for wrist fractures at a popular Colorado ski resort during 5 consecutive seasons.

Methods: We conducted a retrospective chart review analysis of more than 800 patients with wrist fractures at the Denver Health Winter Park Medical Center during the 2012/2013 to 2016/2017 winter seasons. We included all fractures from the distal third of the radius and/or ulna to the proximal row of carpal bones. Chart and imaging review was used to evaluate multiple factors associated with these injuries.

Results: Preliminary data revealed a total of 875 wrist fractures, which was 13.7% of all injuries over the study period. More than half (58%) of the fractures were sustained by men, and 75% of the wrist fractures were sustained by snowboarders. Fractures occurred equally in right and left wrists, and the average age of injury was 22 years. The most common fracture type was Colles fractures. Overall, the total number of wrist injuries decreased from a total of 202 fractures in 2012/2013 season to 153 in 2016/2017 season.

Conclusions: Wrist fractures were more commonly sustained in snowboarders than skiers, men than women, and younger athletes than older athletes. Colles fractures were the most common fracture type.

Significance: This data provides additional insight into the epidemiology of wrist fractures in winter sports participants. This data may be used to advocate for prevention strategies for wrist fractures in winter sports participants such as wrist guards.

TOPIC: Education

Evaluation of Teaching Pediatric Residents Interpretation of Pediatric Musculoskeletal Radiographs

Primary Author/Presenter: Megan Kunkel, MD

Aubrey Armento, MD

Affiliation: University of Colorado School of Medicine, Aurora, Colorado.

Purpose: There is a deficiency in teaching pediatric musculoskeletal (MSK) radiograph (XR) interpretation within general pediatric residency programs, which contrasts with competency needed in independent practice. This necessitated curriculum development and evaluation in one pediatric residency program.

Methods: An anonymous needs assessment was sent to currently enrolled residents. Questions asked about comfort interpreting MSK XR with Likert-scale responses of “very uncomfortable, uncomfortable, comfortable, very

comfortable.” Residents’ preferred learning method of MSK XR interpretation was also assessed. Descriptive statistics were performed for statistical analysis to assess comfort level and goals.

Results: Of 118 residents enrolled in one pediatric residency program, 46 (39%) completed the needs assessment. At least 80% of residents indicated discomfort (either “uncomfortable” or “very uncomfortable”) in accurately interpreting radiographs of the wrist, shoulder, elbow, pelvis, knee, and ankle. No residents (0%) were “very comfortable” with interpreting any XR. Residents expressed the most comfort in interpreting leg XR, with 25% of residents ranking leg as “comfortable” for interpretation. When asked about preferred educational platforms, 20% of residents indicated preference for email case-based series as curricular mode of delivery, along with in-person lecture. Identified goals included increasing comfort with identifying common pediatric MSK fractures (71.1%), comfort in identifying less obvious fractures (15.6%), ability to identify urgent MSK findings (11.1%), and learn a systematic approach to interpreting MSK radiographs (6.7%).

Conclusions: This needs assessment demonstrated pediatric residents’ low comfort with interpreting any MSK XR across one residency program. It also demonstrated the majority of residents preferred further education in email case-based series or in-person lecture. Residents indicated their primary goals with further education are to improve comfort in identifying common and subtle pediatric MSK XR.

Significance: This study helps address the disparity of reading pediatric MSK XR in resident education in one pediatric residency program. This will help inform the development and implementation of pediatric MSK XR curricular content and delivery for residents.

Acknowledgments: We thank the pediatric residents that participated in this study.

TOPIC: Other

STUDY: Survey

Trends in Racial and Ethnic Diversity in Family Physicians in Sports Medicine Fellowships

Primary Author/Presenter: Kyle Lau, MD

Zachary Morgan, MS, Tina Wang, PhD, James Puffer, MD, and Lars Peterson, MD, PhD

Affiliation: Lancaster General Health Family Medicine Residency, Lancaster, Pennsylvania.

Purpose: This study describes the trends and characteristics of family medicine physicians who attended a primary care sports medicine fellowship between 2014 and 2020 in order to assess ways to increase diversity in sports medicine.

Methods: Data was collected and analyzed from the self-reported data from the demographics section of the application to sit for the American Board of Family Medicine certification examination from 2014 to 2020.

Results: Between 2014 and 2020, there was an increase in graduating family medicine residents and increase in family medicine physicians who attended sports medicine fellowships; however, the number of underrepresented minorities remained stable in the same time period. There was an increase from 28.3% to 31.1% of family physicians who identify as female who pursued a sports medicine fellowship. Furthermore, osteopathic family physicians who pursued a sports medicine fellowship increased from 28.9% to 45.0%, but

there was a decrease of international medical graduates from 21.7% to 12.9% in that same time frame.

Conclusions: There has not been a significant increase in underrepresented minorities among family physicians who pursue a sports medicine fellowship from 2014 to 2020.

Significance: There is limited information on describing the racial and ethnic composition of sports medicine physicians, and efforts need to be improved to increase the diversity among sports medicine physicians.

Acknowledgments: The American Board of Family Medicine for providing data to support this study.

TOPIC: Musculoskeletal

STUDY: Cohort

Epidemiology of Anterior Cruciate Ligament Ruptures During the 2010/2011 to 2021/2022 RPL Seasons

Primary Author/Presenter: Artemii Lazarev, MD

Eduard Bezuglov, Sergey Izmailov, Anton Emanov, Igor Stepanov, and Ryland Morgans

Affiliation: Mount Sinai Hospital, Chicago, Illinois.

Purpose: To investigate the epidemiology of Anterior Cruciate Ligament Ruptures (ACLR), the patterns associated with their occurrence, and the return to play (RTP) in professional soccer players during the 2010/2011 to 2021/2022 competitive seasons in Russian Premier League (RPL).

Methods: All ACLR sustained by players competing in the RPL across 12 competitive seasons from 2010/2011 to 2021/2022 were analyzed. All data were obtained by 3 independent experts via a media analysis and confirmed by cross-checking with team physicians. In case of disagreement, all information was clarified by the player. Outcomes of ACLR as well as RTP duration were collected.

Results: Eighty-five players (age 26.2 ± 3.5 years) sustained 100 injuries (76 primaries) during the examined period—8.3 ACLR per season. There were 47 ACLR in the first half, and 53 in the second half of the studied period. There was an increase in the number of injuries in August and September as well as the January to March. Players from the most competitive teams were affected most often. Central and wide midfielders suffered sustained the most injuries (25% and 22%, respectively) while goalkeepers were the least injured (6%). Most injuries ($n = 58$) occurred during the official game. A total of 76 ACL reconstruction surgeries were performed with a 14.5% ($n = 11$) re-injury rate in the ipsilateral knee, and 5.2% ($n = 4$) injuries in the contralateral knee. The mean time to RTP after primary surgery was 289 ± 136 days.

Conclusions: The epidemiology of ACLR does not significantly differ from other championships. ACLR number has not increased significantly over the last 12 years. The majority of injuries occurred during the official game in the first 2 months after the season commencement and also in the first months of the calendar year. Re-injuries are relatively common after ACL repair, and RTP time is lengthy. Players from the most competitive teams suffered more often.

Significance: ACLR require surgical treatment, long RTP time, and pose significant risks for re-injury and contralateral knee injury. Understanding of ACLR patterns will aid the development of injury prevention programs with a focus on players most at risk.

TOPIC: Epidemiology

STUDY: Other

Ball Sport- Related Injuries Among Females Presenting to United States Emergency Departments 2012-2021

Primary Author/Presenter: Anusha Lekshminarayanan, MD
Petra Abou Lhosn, MD, Elver Ho, BS, and Shane Drakes, MBBS

Affiliation: Montefiore Medical Center, NYC H+H/Jacobi, Bronx, New York.

Purpose: There has been a significant increase in female participation in sports throughout the years. Some studies suggest that females are at a greater risk of sport injuries than men possibly due to difference anatomical structure, hormones, nutrient deficiencies & differences in movements.

Methods: A total of 5166 ball sport related injuries in females contained within the National Electronic Injury Surveillance System over a 10-year period (January 2012 to December 2021) were analyzed. Data was filtered to remove ball sports that were entered with naming errors finally narrowing down to 5166 injuries.

Results: Among females who played ball sports, injuries were mostly sustained in the 0 to 19-year age group (69.7%), mean age was 21 years, with most of the injuries in the high school group (33.1%) followed by middle school (20.8%) and elementary school (15.5%). Most common ball sports played while sustaining injury include kickball (32.4%), lacrosse (24.6%), dodgeball (17.1%) and rugby (14.6%). Majority of participants were Caucasian (42.1%) followed by African American (15.6%) race. Injuries to the head (18.8%), ankle (13.6%) and knee (11.9%) were the most common. Strains/sprains were the most common type of injury (30.5%) followed by fracture (18.2%) and contusions and abrasions (11.7%). Most injuries were sustained at a “sports” location (48.1%) followed by “school” location (27.1%).

Conclusions: Ball-sport-related injuries among women were mostly noted among high school kickball and lacrosse players and sustained in a sports arena setting. Strains/sprains and head injuries were the most common diagnosis and type of injuries.

Significance: Head injuries could be due to the high impact and contact nature of kickball, lacrosse, dodgeball and rugby. Helmets and other protective gear should be strongly recommended to all women playing ball sports, especially high school kids.

Acknowledgments: Thank you, Dr Diamond, for introducing me to this database.

TOPIC: NCAA

STUDY: Cohort

Examining Vertical Jump Metrics in Intercollegiate Soccer Players

Primary Author/Presenter: Sean Loose, MD

Amanda Delaney, MS, David Webner, MD, and Thomas Kaminski, PhD, ATC

Affiliation: Crozer Health Sports Medicine, Springfield, Pennsylvania.

Purpose: Sport performance enhancement has become an integral aspect of intercollegiate sport success. The purpose of this study was to examine differences in vertical jump metrics

in intercollegiate soccer players with and without recent lower extremity injury (LEI) using advanced force plate technology.

Methods: Twenty soccer players were grouped into uninjured ($n = 10$) or injured ($n = 10$) based on their recent history of LEI. Vertical jump force plate metrics included Sparta Score, load (average eccentric RFD), explode (relative concentric force), and drive (concentric relative impulse) extracted from Sparta Science software as T-scores normalized by sex. Data were analyzed using independent t -tests.

Results: The variables studied included Sparta Scores ranging from 74 to 85; load scores ranging from 33 to 69; explode scores ranging from 31 to 65; and drive scores ranging from 26 to 75. There were no significant differences in Sparta Scores ($t = 0.554$, $df [18]$, $P = .593$) between the uninjured (79.5 ± 2.7) and injured (80.3 ± 3.8) groups. Likewise there were no significant differences in load scores ($t = 0.331$, $df [18]$, $P = 0.744$) between the uninjured (44.3 ± 9.7) and injured (43.1 ± 6.1) groups; explode scores ($t = 0.621$, $df [18]$, $P = 0.542$) between the uninjured (44.8 ± 8.8) and injured (47.5 ± 11.2) groups; and jump drive scores ($t = 0.262$, $df [18]$, $P = 0.797$) between the uninjured (51.9 ± 10.3) and injured (53.2 ± 11.9) groups. The corresponding small Cohen's effect sizes for Sparta Score ($d = 0.24$), load ($d = 0.15$), explode ($d = 0.27$), and drive ($d = 0.17$) variables likely represent the true nature of the lack in differences between the groups.

Conclusions: Intercollegiate soccer players who sustained a LEI within the year prior to their vertical jump assessment did not see any significant differences in their force plate metrics when compared to their matched controls. Our results suggest that the recent history of LEI did not impair jump kinetics, perhaps suggesting that a return to pre-injury performance was attained following rehabilitation.

Significance: Movement efficiency, as assessed by a vertical jump scan via the Sparta Science system, is important to sports performance specialists in assessing rehabilitation progress from sports-related injuries.

TOPIC: Concussion

STUDY: Cohort

Sex Differences in Risk of Lower Extremity Injury After Sport-Related Concussion in Collegiate Athletes

Primary Author/Presenter: Amber MacFarlane, DO

Thomas Buckley, EdD, Melissa Anderson, PhD, Scott Passalugo, BS, and David Baxter, DO

Affiliation: Crozer Health Sports Medicine, Springfield, Pennsylvania.

Purpose: An approximate 2-fold risk of musculoskeletal (MSK) injury in the year post-concussion is well established however, sex differences has less studied data. This study investigates sex differences in the post-concussion risk of subsequent lower extremity injury in collegiate athletes.

Methods: There were 144 participants (Female: 85) with sport-related concussions who were tracked for one year for a subsequent MSK injury. Sports that were not sex matched (e.g., football, lacrosse) were excluded leaving 104 participants. Injury was defined as requiring treatment, but not time loss. A binary logistic regression compared subsequent MSK injury (yes or no) within one year between sexes.

Results: There were 60 participants (57.7%) with a subsequent lower extremity MSK injury (mean 1.4 ± 0.7 injuries, Range: 1-4) within 1 year post-concussion. There was no difference between Males (72.2%) and Females (52.8%) for subsequent injuries ($F = 2.527$, $P = 0.062$). When controlling for concussion history (Yes or No) and sport type (Contact or Non-Contact), sex was not a significant predictor of subsequent lower extremity MSK injury ($P = 0.145$, Nagelkerke $R^2 = 0.094$).

Conclusions: Concussions are one of the most common sport-related injuries with a known relationship of an increased risk of subsequent lower extremity MSK injury. When non-sex matched high injury risk sports are removed, there is no elevated risk of subsequent lower extremity MSK injury between sexes suggesting neurological, rather than biological factors may underlie this elevated risk as persistent post-concussion deficits have been noted across sexes.

Significance: About 60% of athletes experience an injury post-concussion however, based on this data the rate does not differ between sexes. Future research of additional risk factors for injury post-concussion will continue to be important for injury prevention.

TOPIC: Pediatrics

STUDY: Other

Associations Between Exercise, Body Size, and Nutrition Behaviors in Adolescent Athletes

Primary Author/Presenter: Kana Maeji, DO

David Howell, PhD, Casey Little, BS, Madison Brna, BS, Amanda McCarthy, MS, RDN, CSSD, and Aubrey Armento, MD

Affiliation: University of Colorado, Denver, Colorado.

Purpose: The development of healthy habits at a young age may promote well-being into adulthood. This study examined the relationship between body size, exercise habits, and nutrition behaviors in an adolescent athlete population.

Methods: We conducted a retrospective chart review of data collected during a sports nutrition consultation at a single institution. All patients in the study were seeking care for nutrition needs with a sports dietitian. The grouping variables included exercise frequency, and exercise duration, and the primary outcome measures were demographic and medical history, body size, and nutrition habits.

Results: We included data from 93 patients (14.6 years of age; 57% female, 42% male, 1% other). They were grouped by exercise frequency ($n = 10$ did not report, $n = 49$ exercised ≥ 6 d/wk, $n = 34$ exercised ≤ 5 d/wk) and average exercise duration ($n = 39$ reported exercising >90 min/exercise session; $n = 54$ reported exercising ≤ 90 min/exercise session). A higher proportion of those who exercised ≥ 6 d/wk were female patients (68% vs 51%; $P = 0.07$), reported regularly drinking energy drinks (14% vs 0%; $P = 0.02$), and reported resistance training on a regular basis (45% vs 18%; $P = 0.01$) compared to those who exercised ≤ 5 d/wk. A greater proportion of patients who reported exercising >90 min/exercise session reported a recent weight change (21% vs 44%; $P = 0.02$) compared to patients who reported exercising less. There were no significant demographic, medical, body size, or nutrition differences between exercise frequency or duration groups.

Conclusions: In the adolescent athlete population studied, there was not a significant correlation between exercise habits, nutrition habits, or body size with the exception of the higher

frequency exercisers reporting more energy drink consumption and more frequent resistance training.

Significance: Our findings suggest that there may not be a significant relationship between exercise frequency, body size, and nutrition behaviors. Future studies can identify factors associated with unhealthy exercise and nutrition habits to improve outcomes.

Acknowledgments: University of Colorado Children's Hospital of Colorado.

TOPIC: Musculoskeletal

STUDY: Survey

Significant Relief of Osteoarthritic Knee Pain After US-Guided Peripheral Nerve Stimulation for 60 Days: A Case Series Study

Primary Author/Presenter: Henry (Haihong) Mao, MD

Affiliation: Indiana University Health Physicians, Indiana University School of Medicine, Primary Care Sports Medicine, Indianapolis, Indiana.

Purpose: It is challenging to treat patients with chronic osteoarthritic (OA) knee pain who failed conservative treatments and are not candidates for TKA. US guided peripheral nerve stimulation (PNS) has become an emerging treatment option. This study is to validate the methods and efficacy of PNS treatment.

Methods: We evaluated 38 cases of OA knee pain which had undergone US guided PNS dual-channel implantation with different combination of nerves. The stimulated nerve selections varied depending on the patient's pain location. The PNS systems were removed after 60 days treatment. The primary outcome measured was the percentage pain relief reported by patients at 2 weeks and 2 months after implantation.

Results: The average age of patients in this study was 75 (± 13) years old at the time of procedure. The body mass index (BMI) ranged from 23.1 to 54.7, and averaged BMI was 36.3. Kellgren-Lawrence (KL) grading scale was used to assess the severity of knee OA. The average KL score was 3.3 (moderate to severe). Saphenous and Femoral nerves were selected for anterior and medial knee pain, and Sciatic nerve was selected for posterior and lateral knee pain. Among the 38 patients, 31 patients were selected for Saphenous and Femoral nerves treatments, 4 patients were selected for Saphenous and Sciatic nerves treatments, and 3 patients were selected for Sciatic and Tibial nerves treatments. The nerve stimulation leads were implemented under US guidance. No neurovascular complications were reported during and after procedures. All patients had responded to the 60 days PNS treatment. On average, patient-reported improvement of pain level was 70% at 2 weeks follow-up and 83% at 2 months follow-up.

Conclusions: All patients with OA knee pain in this study had responded of pain relief after 60-day PNS treatment. The dual channel system allows various combination of nerves stimulation based on the patient's pain location. Most of the patients had significant pain relief at 2 weeks and 2 months follow-up. US guided PNS system is a promising treatment option for patients who failed conservative treatments but not good candidates for knee replacement.

Significance: This study is the first retrospective review of patient outcomes after 60 days of PNS treatment for osteoarthritic knee pain. US guided PNS system provides an innovative treatment option with promising pain reduction for chronic knee osteoarthritis.

Acknowledgments: Appreciate the excellent service provided by Dara Clem and Shawn Harmon from SPRINT PNS Therapeutics.

TOPIC:STUDY: Cohort

Vestibuloculomotor and Near Point Convergence Deficits in Long COVID Patients With Prolonged Visual and Vestibular Symptoms

Primary Author/Presenter: Tyler Marx, BS, MS

Taylor Seitz, Daniella Rivera, Leslie Streeter, DNP, Leila Samsam, DNP, Sarah Lawson, DO, and Mo Mortazavi, MD

Affiliation: Arizona College of Osteopathic Medicine, Midwestern University, Glendale, Arizona.

Purpose: To identify abnormal vestibular oculomotor (VOM) deficits and near point of convergence (NPC) in patients suffering from persistent long COVID visual and vestibular symptoms.

Methods: Retrospective review of 15 long COVID patients, ages 13 to 66 (avg 45), with an average of 9 months from COVID infection to evaluation. VOM testing, including NPC, was completed at each visit evaluating balance, vision, and head/eye movements. Vestibular and visual symptom profile scores were also assessed using the Concussion Clinical Profiles screening tool (CP screen) in each patient.

Results: Patients were tested for symptom exacerbation with vestibulo-ocular reflex (VOR), saccades (Sacc), and visual motion sensitivity (VMS), and smooth pursuits (SP). 11/15 were positive for at least one VOM test component. The highest-scoring categories were hVOR, VMS, and Sacc. Of the 15 patients, 11/15 were positive for hVOR, 9/15 were positive for VMS, 7/15 were positive for Sacc, and 2/15 were positive for choppy pursuits. 4/15 tested negative for all 4 categories and 2/15 tested positive for all 4 categories. NPC average was 13.6 cm (normal range $<6-8$ cm). Average visual profile score was (0.9/3) and average vestibular profile score was (0.8/3). There was a significant positive correlation between NPC and visual profile score ($P = 0.003$). While not significant, there was a positive correlation between NPC and vestibular profile score ($P = 0.0767$). In addition, there was a positive correlation between VOM deficits and visual profile score ($P = 0.1198$) and vestibular profile score ($P = 0.4844$).

Conclusions: Long COVID patients with visual and vestibular symptoms demonstrated abnormal VOM testing and a significantly higher NPC on average. These findings appear to parallel similar functional neurologic findings in persistent post-concussive syndrome.

Significance: Patients with neurologic sequelae of long COVID should be formally evaluated with a VOM screen and an NPC test in order to identify and measure physiological deficits for appropriate intervention and potential rehabilitation.

Acknowledgments: I would like to acknowledge all the hard work all the authors put in to complete this research project.

TOPIC: Concussion

STUDY: Cohort

Utilizing Clinical Biomarkers as Predictors for Progression Throughout the 5 Step Active Rehab Protocol in Concussed Patients

Primary Author/Presenter: Tyler Marx, BS, MS

Alicia Chen, BS, Mo Mortazavi, MD, Hirsch Handmaker, MD, and Jon Minor, MD

Affiliation: Arizona College of Osteopathic Medicine, Midwestern University, Glendale, Arizona.

Purpose: The near point of convergence (NPC) oculomotor test, and King-Devick (KD) test, can be used as clinical biomarkers when assessing patients with concussion symptoms. These are easily performed tests, and we believe these measurements can be utilized as a clinical predictor for exercise tolerance.

Methods: We performed a retrospective cohort study of 60 patients with 239 clinical visits. NPC was measured with a digital ultrasonic device, and KD time was measured as a sum of 3 rounds with associated cards. Patients went through a 5-step Active Rehab Protocol (ARP) exercise tolerance test increasing in intensity from step 1 to step 5 with step 5 additionally utilizing multidirectional movement.

Results: The mean NPC for patients in the ARP step 1 to 5 exercise protocol was 17.36, 16.16, 13.61, 10.96, and 8.75 cm respectively. When comparing an NPC measurement of 8 cm from the healthy population, the patients in ARP step 1 ($P < 0.0001$), step 2 ($P < 0.0001$), step 3 ($P < 0.0001$), and step 4 ($P = 0.0008$) were significantly higher than 8 cm. However, patients in step 5 ($P = 0.1283$) were not significantly different from 8 cm when utilizing a one-sample t -test. The mean sum KD time for patients in the ARP step 1 to 5 was 63.25, 54.64, 49.81, 43.88, and 41.6 seconds respectively. When comparing a sum KD time of 42.2 seconds from the healthy population, the patients in ARP step 1 ($P < 0.0001$), step 2 ($P < 0.0001$), and step 3 ($P = 0.0066$) were significantly higher than 42.2 seconds. In contrast, patients in step 4 ($P = 0.1809$), and step 5 ($P = 0.6003$) were not significantly different from 42.2 seconds when utilizing a one-sample t -test.

Conclusions: A lower NPC and sum KD time measurement was observed with higher exercise tolerance. Patients in ARP step 5 exhibit similar NPC and sum KD time and patients in ARP step 4 exhibit similar sum KD time to the healthy population. In contrast, patients with a significantly lower NPC (ARP step 1, 2, 3, and 4) and sum KD time (ARP step 1, 2, and 3) have a lower exercise threshold.

Significance: These findings signify that patients with certain NPC and sum KD time measurements can accurately be placed into the correct ARP Step to successfully complete an exercise bout. This is important when planning concussion rehabilitation for patients.

Acknowledgments: I would like to thank everyone involved in this research project.

TOPIC: Education

STUDY: Survey

Finding Diversity, Inclusion, and Equity in Sports Medicine Fellowships: A Regional Review of US Program Websites

Primary Author/Presenter: Matthew Mayeda, DO, MPH
Allison Lukacic, MPH, DO, Gabriela Meckler, MD, and
Esther Funez Castro, DO, MPH

Affiliation: Santa Rosa Family Medicine Residency, Santa Rosa, California.

Purpose: Diversification of medical providers is essential to eliminating health disparities and optimizing patient care. This study investigates the prevalence of diversity, equity, and inclusion (DEI) on sports medicine fellowship program websites, which may improve diversity recruitment efforts.

Methods: Data were collected from the American Medical Society for Sports Medicine's (AMSSM's) list of US-affiliated

sports medicine fellowship programs' website links. The words "diversity," "equity," and "inclusion" were searched within the functioning websites. A χ^2 test of independence was run utilizing the US Census Bureau's Region Designations for States: West, Midwest, South, and Northeast.

Results: Among the 212 US-affiliated sports medicine fellowship programs listed on the AMSSM website, 149 or 70% of programs had links to functioning program websites. Of those functioning websites, a total of 51 websites mentioned "diversity," "equity," or "inclusion," (DEI) for an overall prevalence of 34%. By US region, the prevalence of DEI on functioning websites was 40% (12/30) for the Midwest, 24% (8/33) for the Northeast, 35% (19/54) for the South, and 38% (12/32) for the West. A χ^2 test of independence showed there was no significant association between a program's region within the US (West, Midwest, South, and Northeast) and DEI representation on a program's website, $X^2 (1, N = 149) = 2.08, P = 0.56$.

Conclusions: Overall, there is a significant amount of US sports medicine programs without active AMSSM website links, and those with active links do not commonly include DEI as a component of their webpage. Regionally, there is no statistically significant difference in including DEI on program web pages; therefore, there is substantial room for improving DEI representation within sports medicine fellowship programs webpages in all regions of the US.

Significance: By improving meaningful DEI work including representation on fellowship pages, sports medicine as a field could better recruit a diverse physician workforce and reduce health disparities.

Acknowledgments: We would like to acknowledge the sports medicine fellowship programs that have put significant time and effort into developing meaningful DEI-specific missions, events, and resources. Your dedication to DEI is visible and inspired us throughout this research.

TOPIC: Education

STUDY: Survey

Piloting a Musculoskeletal Curriculum for Internal Medicine Residents

Primary Author/Presenter: Jaclyn McKenna, MD

Dylan Bennett, MD and Sarita Warriar, MD

Affiliation: The Warren Alpert Medical School of Brown University/Rhode Island Hospital.

Purpose: This study aims to assess the attitudes of general internal medicine (GIM) residents toward their education on musculoskeletal (MSK) conditions and determine if incorporating a hands-on educational intervention improves their confidence in the diagnosis and management of MSK complaints.

Methods: Fifteen GIM residents were surveyed on their attitudes toward their education in MSK topics as well as their confidence in assessing, examining, and managing various MSK problems. The residents then participated in a 5-part MSK workshop series over 18 months. Each workshop included a lecture and physical exam simulation and direct observation. The survey was repeated after the final workshop.

Results: Data was collected from pre- and post-intervention surveys using a 5-point Likert scale. Prior to the intervention, residents felt that MSK education was important (mean 4.07/5, SD 1.07) and additional training would be beneficial to

their future clinical practice (mean 4.29/5, SD 1.07). They also felt that medical students and residents do not receive adequate training in MSK medicine (mean 2.21/5, SD 0.80 and mean 2.5/5, SD 0.65, respectively). When comparing confidence levels pre- and post- intervention, we found improvement in all categories assessed, with statistically significant improvements in taking a MSK history (3.21-4.21, $P = 0.010$), performing a MSK exam (2.57-3.93, $P = 0.001$), and identifying indications for obtaining imaging (3.14-4.21, $P = 0.022$) and specialty referral (3.00-4.29, $P = 0.002$). Based on the comments provided, participants felt that the opportunity to practice the MSK exam with direct observation was particularly helpful.

Conclusions: Most GIM residents believe that medical school and residency education on MSK topics is insufficient, yet these topics are important for their future practice. The addition of a MSK workshop series, and particularly one that involves practicing examination skills with direct observation, improved residents' confidence in assessing and managing MSK ailments.

Significance: GIM residents require education on a large breadth of medical conditions, however the amount of time devoted to MSK topics is disproportionately low relative to the frequency these conditions present. Dedicated teaching is beneficial and warranted.

TOPIC: Ultrasound

STUDY: RCT

Interventional Ultrasound Accuracy Among Trainees After Multimedia Education vs Usual Education: A Randomized Control Trial

Primary Author/Presenter: Sharnee Mead, DO

Suzanna Shermon, DO, Terence Hillery, MD, and Chong Kim, MD

Affiliation: MetroHealth Rehabilitation Institute, Cleveland, Ohio.

Purpose: Currently there is no evidence-based technique for instructing trainees on ultrasound (US)-guided musculoskeletal injections. This study seeks to compare 2 training methods: (1) a 5-minute video on US-guided glenohumeral joint injection (GHJI), and (2) a 5-minute review of textual resources.

Methods: PM&R residents were randomized to video or text training groups, stratified by seniority. The text training group was given 5 minutes to consult reference texts on performing US-guided GHJI. The video training group watched a 5-minute video demonstrating an US-guided GHJI technique. Subjects then underwent a timed US-guided GHJI on a shoulder model and data was collected by a blinded investigator.

Results: There were 16 participants (6 PGY-2s, 5 PGY-3s and 5 PGY-4s); 8 in the video training group and 8 in the text training group. No difference was found between groups on successful first attempt (38% vs 25%), total time for procedure (1.57 minute vs 1.93 minute), number of needle withdrawals (6 vs 8), or success rate by the end of the procedure (50% vs 38%). Comparing results based on class, there was a significant difference between PGY-4 participants and the remaining classes on successful first attempt (80% vs 17%), total procedure time (0.95 minute vs 1.52 minutes and 2.84 minutes), and number of needle withdrawals (2 vs 7 and 11). No differences were found between groups or classes in

pre-training or post-training confidence in operating the machine, performing US-guided procedures, teaching other learners, and attaining a target location under restricted time.

Conclusions: A brief video teaching US-guided glenohumeral joint injections to residents was not superior to reading current reference materials. Further studies are needed to attain larger sample sizes, compare injection mediums and compare other information delivery methods.

Significance: This study suggests non-inferiority of video explanation versus traditional textbook review on ultrasound procedure techniques for resident education.

Acknowledgments: Thank you to Hanna Hill, MS, for contributing to the statistical analysis of this study.

TOPIC: Concussion

STUDY: Cohort

Which Measures Can Safely Predict Return Driving Following a Concussion in Athletes?

Primary Author/Presenter: Matthew Miesch, MD, MS

Navneet Baidwan, PhD, Hairui Yu, PhD, Benjamin McManus, PhD, Irfan Asif, MD, Ian McKeag, MD, MS, and Despina Stavrinou, PhD

Affiliation: University of Alabama-Birmingham, Birmingham, Alabama.

Purpose: Compiling data from a follow-up study built from last year's research that demonstrated the Balance Error Scoring System (BESS) as a poor indicator when assessing when it's safe for a patient to return to drive. Will another assessment tool predict poor driving outcomes following a concussion?

Methods: Driving performance and balance (BESS) were again compared b/w pts w/a concussion w/in 1 week (experimental) and healthy controls. Four experimental drives (2 with distractions and 2 without) were completed weekly for 4 consecutive weeks, beginning at 1 week of injury. Driving outcomes were assessed using a car simulator and included 2 variables: speed and lane deviation.

Results: Ten individuals ($n = 2$ control and $n = 8$ experimental) participated (average age = 17.5 y/o; 54% female; 62.5% Caucasian; 37.5% African American). The standard deviation of velocity averaged across the drive ($P = 0.043$) significantly decreased between week 1 and week 3 in control groups with load present and no event. In comparison, the changes in BESS scoring was not significantly related to changes in average speed, variability, or lane variability in the experimental group. We provide descriptive statistics including t -tests comparing the concussion and control groups, also looking within BESS categories.

Conclusions: Consistent with last year, poor BESS scores in recently concussed individuals were not indicative of speed modulation or poor driving efficiency when compared to subjects without concussion. Poor balance was not indicative of significant deviation from the center lane in either group. Future analyses will involve comparing these estimates using generalized estimating equations, controlling for relevant demographic and injury related covariates.

Significance: The BESS continues to not be solely predictive of speed modulation or lane deviation while driving. Further studies are needed to determine if any different measures during routine concussion evaluations can safely predict return driving s/p injury.

Acknowledgments: The authors would like to thank the UAB Department of Psychology for helping facilitate this study.

TOPIC: Concussion

STUDY: Cohort

Characterizing Head Acceleration Exposure in Women's Artistic Gymnastics

Primary Author/Presenter: Christopher Miles, MD, FAMSSM

N. Stewart Pritchard, MS, David Kruse, MD, Garrett Bullock, D.Phil, Laura Lintner, DO, Justin Moore, PhD, Joel Stitzel, PhD, and Jill Urban, PhD

Affiliation: Wake Forest University School of Medicine, Winston-Salem, North Carolina.

Purpose: Existing post-concussion return to play (RTP) protocols do not fully address the multifaceted loading environment of gymnasts. The purpose of this study was to characterize head acceleration exposure in women's artistic gymnastics to inform development of a biomechanically-based RTP.

Methods: Participating gymnasts wore mouthpiece-based acceleration measurement sensors during all training activities over an 11-week period. Sensors collected data at 100 Hz when the accelerometer exceeded 3 to 3.5 g along any axes for at least 10 milliseconds. Sensor recordings were paired to video and segmented into skills, contacts, and non-contact events. Intermittent clinical assessments were also obtained.

Results: Beginner ($n = 9$) and advanced ($n = 9$) level gymnasts (age 11-15) participated in this study. Gymnasts participated in a total of 643 athlete exposures (AE). 2937 event exposures (i.e., one athlete participating in one training event) were identified. In total, 308 hours of uneven bars activity, 279 hours of balance beam activity, 235 hours of floor activity, and 198 hours of vault activity were monitored. A total of 23908 recordings were recorded by the sensors, of which 6903 (29%) occurred during floor, 5968 (26%) occurred during bars, 5369 (22%) occurred during vault, and 4568 (19%) occurred during beam. In total, 169 AE corresponding to 9765 events were reviewed. Twelve unique skill scenarios were identified including: 2769 handsprings, 2232 bar elements, 1686 somersaults, 1389 rebounds, 1238 round-offs, 942 jumps, 738 other skill types, 272 rolls, 253 leaps, 119 handstands, 93 twists, and 12 walkovers. One athlete sustained a concussion and had pre and post injury review.

Conclusions: Head acceleration exposure can be quantified in terms of skill and training event exposure. Gymnasts trained most often on uneven bars, but a many recordings were measured on floor. The most common skills were handsprings and bar elements. Continued work involves studying linear and rotational motion of the head during identified skills. Future work is needed to compare the potential effect of head acceleration exposure on neuro-behavioral health.

Significance: Gymnastics is a leading cause of head injury among sports, yet post-concussion RTP protocols for gymnasts have scarcely been researched. This study provides key data that can be used to inform future development of RTP protocols for gymnasts.

Acknowledgments: The authors would like to acknowledge Spencer Faircloth, Grace Waters, Autumn Knight, and Konstantina States for their efforts in data collection. This study was supported by the National Institutes of Health through grant numbers R03 HD104894 and R21 HD1.

TOPIC: Other

STUDY: Survey

Team Physician Preference in Diagnosing Exercise-Induced Bronchoconstriction and Asthma in College Athletes

Primary Author/Presenter: Ryan Muehling, MD

Luke Stephens, MD, MSPH

Affiliation: University of Missouri-Columbia.

Purpose: The focus on this survey was to report team physicians' preferences and availability for methods of diagnosis of asthma or exercise-induced bronchoconstriction within their college athletic populations.

Methods: An online survey was sent to all AMSSM members, which was targeted at current and recent college team physicians. This survey was reviewed and approved by an AMSSM committee, and this organization distributed the survey to all members on 2 occasions, 6 weeks apart. The survey was available from November 2021 to January 2022. Qualtrics was utilized for data collection and analysis.

Results: Total responses were 133, with 86% attending, 11% fellow and 3% resident physicians. Surveyed physicians included 92% with NCAA teams, with 62% at the division I level. As desired, 76% care for college athletes in training rooms/sidelines currently, with another 11% having provided care in the past 10 years. The remainder included physicians who provide care only in the clinic or complete physicals. Physicians reported available testing at exercise treadmill challenge 53%, exercise field challenge 43%, methacholine challenge 37%, exercise bike/ergometer challenge 26%, eucapnic voluntary hyperpnea (EVH) 10%, mannitol challenge 7%, with 23% unsure of their options. For diagnosis of asthma, 56% required documentation of objective testing, with 31% reported utilizing a positive response to medication for diagnosis. For EIB, diagnosis was preferred through objective testing at 54%, response to medication at 39%, with exercise treadmill challenge as the preferred testing method at 23%.

Conclusions: This survey demonstrates that college team physicians do not report consistent methods with diagnosis of EIB and asthma in their athletes. Access to objective testing for asthma and EIB were reported as limited by respondents. Additional studies are indicated to determine if the methods utilized by team physicians is a result of this limited access to testing methods or due to other factors in the evaluation process of college athletes.

Significance: This online survey of AMSSM members reports the availability and preferred testing methods of team physicians who care for college athletes with asthma and EIB concerns, which is not currently published.

Acknowledgments: Special thanks to the AMSSM for allowing this survey to take place and to all of those who responded to the survey.

TOPIC: Training

STUDY: Survey

Can Training Parent Coaches Improve Identification of Youth Sports Injuries

Primary Author/Presenter: Christian Muller, DO

Kimberly Smith, PhD, Hairui Yu, PhD, and Irfran Asif, MD

Affiliation: University of Alabama Birmingham, Birmingham, Alabama.

Purpose: Approximately 90% of youth sport coaches are parents. Currently, no national standardized training for coaches of youth athletes ages 5 to 14 years old exists. This study evaluates the importance of youth sport coach training to determine if training effects the identification of youth sport injury.

Methods: An 11-module training course on youth sport safety was developed and offered to coaches nationally. A survey was distributed to trained parent coaches (PC) and to parents without training to assess demographics, importance of training, and athlete visits to a clinic/ED. Descriptive and comparative analyses (χ^2 , t -test, ANOVA, and Logistic Regression) were used to examine group differences.

Results: Three thousand two hundred eighty-one participants (mean age 39.9 years, 44.4% male, PC 44.9%, 55.1% parents) completed the cross-sectional survey in Spring 2022. Respondents lived in urban (84.1%), suburban (12.2%), and rural (3.7%) areas. In total, 50.5% reported athlete clinic/ED visits. There was a significant difference in clinic/ED visits between PC (57.7%) and parents (23.0%; $P < 0.001$), male (53.3%) and female (46.7%; $P < 0.001$), as well as urban (85.7%), suburban (11.1%), and rural groups (3.1%; $P = 0.035$). Using a regression model, past experience of being a PC was a statistically significant predictor of athlete clinic/ED visits (Beta = 1.50, $P < 0.001$). Chi Square analysis showed there were significant differences in athlete clinic/ED visits between trained PC and parents of urban, suburban, and rural areas ($P < 0.001$). There was no group difference for importance of training. Both groups ranked coaching behavior (PC 16.1%, parents 15.2%) and concussion (PC 14.8%; parents 14.1%) as most important to youth sports safety.

Conclusions: Parent coaches, with coaching safety training, are more likely to recognize signs of injury in youth sport athletes ages 5 to 14 years old compared to parents who have not had this training. Overall, parent coaches and parents rated modules on coaching behavior and concussion as being most important to their education on player safety. Parents and coaches in rural areas were least likely to take their athlete to the clinic/ED for injury.

Significance: No national standard on youth sport safety training exists today. Youth sport coaches/parents with training are more likely to seek medical care for athletes. Disparities to care exist in rural areas and are greatest for parents without training.

Acknowledgments: Data source -DISQO and Coach Safely Foundation.

TOPIC: Musculoskeletal

STUDY: Other

Appropriateness & Usefulness of Lumbar Spine XR Film for Evaluation of Low Back Pain

Primary Author/Presenter: Hirotaka Nakagawa, MD

Kyungje Sung, MD, Nicole Gauthier, BA, and Nadia Zaman, DO

Affiliation: Tufts Medical Center, Boston, Massachusetts.

Purpose: To determine the appropriateness of the lumbar spine x-ray films that were ordered by providers prior to making referrals to our physiatrist, and to determine if there was an association between the appropriateness of lumbar spine x-ray films and subsequent management of low back pain (LBP).

Methods: This was a retrospective study. We used hospital administrative/billing records to pull a list of all patient seen by the principal investigator from 11/2020 to 10/2021. Patient's background information and subsequent management were recorded. Determination for appropriateness was based on the American College of Radiology (ACR) criteria for ordering lumbar spine films.

Results: Forty patients (17%) had lumbar spine x-ray film as the initial imaging study for evaluation of LBP. Of the 40 cases, 55% were considered "usually appropriate", 20% were considered "may be appropriate," and 25% were considered "usually not appropriate." Subsequent images (CT or MRI) were obtained for 41% of the cases in "usually appropriate" group, 75% in "may be appropriate" group, and 20% in "usually not appropriate" group. There was not enough statistical evidence to suggest an association between appropriateness category and subsequent imaging. Non-conservative procedures (i.e., epidural steroid injections, medial branch blocks, radiation frequency ablation, surgery) were performed for 27% of the cases in "usually appropriate" group, 25% in "may be appropriate" group, and 0% in "usually not appropriate" group. There was not enough statistical evidence to suggest an association between the appropriateness category and non-conservative procedures performed.

Conclusions: Majority (75%) of the lumbar x-ray film obtained by referring providers were considered either "usually appropriate" or "may be appropriate." However, the appropriateness of lumbar XR does not seem to affect management, which include subsequent imaging studies ordered and non-conservative procedures performed.

Significance: Majority of lumbar x-ray films obtained by referring providers were considered appropriate. However, appropriateness of lumbar XR does not seem to affect subsequent management of LBP.

Acknowledgments: The authors would like to acknowledge Nicole Gauthier for supporting us through the IRB approval process.

TOPIC: COVID-19

STUDY: Cohort

Are College Athletes Recovering From COVID-19 at Higher Risk For Injury

Primary Author/Presenter: Tammy Ng, MD

Carolynn Patten, PhD, Marcia Faustin, MD, Kevin J. Burnham, MD, Sandra L. Taylor, PhD, Nuen-Tsang Yang, MS, and Daniel C. Herman, MD, PhD

Affiliation: Davis Medical Center, University of California, Sacramento, California.

Purpose: Prior research indicates that deficits in neuro-cognitive function increase injury risk. Given emerging evidence that COVID-19 may result in neurocognitive deficits, this study seeks to determine whether collegiate athletes are at higher risk of injury after return to play (RTP) following COVID-19.

Methods: This pilot study employed a prospective matched cohort design using historical data. Athletes with COVID-19 were matched with controls by sex, sport, starting status, and position, then followed prospectively 365 days after RTP. Marginal Cox proportional hazard models were used to test for differences in time-loss injury rate by COVID-19 status, censoring at 90 and 365 days.

Results: Two hundred forty-six athletes across 11 sports (men's and women's basketball and soccer, men's football and

baseball, and women's lacrosse, volleyball, beach volleyball, softball, and field hockey) were included in this initial analysis. Of the 246 athletes included in this study, 43.9% were female ($N = 108$), while 56.1% were male ($N = 138$). There was tendency towards greater hazard of injury following RTP after COVID-19, both at 90 days ($HR = 1.47, P = 0.074$) and 365 days ($HR = 1.33, P = 0.107$) after RTP, though the effect was not statistically significant. Adjusting for gender, sport, starting status, and injury history within the prior year did not change the results with respect to COVID-19 diagnosis. Interestingly, injury history was not a significant predictor of risk of injury with censoring at 90 ($HR = 0.88, P = 0.666$) or 365 days ($HR = 0.85, P = 0.502$) after RTP. The results were similar when the type of sport was excluded in the multivariable model.

Conclusions: Based on this pilot dataset, there is a non-significant trend towards increased injury rate among collegiate athletes following RTP after COVID-19. The use of an expanded dataset, including athletes in other sports or a multi-institution approach to attain additional power is warranted to further assess this trend. Focusing on athletes with specific symptom profiles such as the presence of neurocognitive symptoms may also be beneficial.

Significance: If a relationship of COVID-19 on subsequent injury risk is confirmed with larger datasets, knowledge of this effect may aid clinical return to play decision-making and the potential use of injury risk reduction measures.

Acknowledgments: The authors would like to thank the UC Davis Intercollegiate Athletics Sports Medicine Team, UC Davis Sports Medicine Oversight and Continuous Quality Improvement Committee (SMOCQI), the Department of Pediatrics, and the UC Davis Health Clinical.

TOPIC: Musculoskeletal

STUDY: Survey

Clinical Outcomes and Patient Satisfaction Following Shockwave Therapy for Tendon vs. Bone Pathologies

Primary Author/Presenter: Parker Nguyen, BS

Charles Kenyon, DO, MS, CSCS and Kenneth Mautner, MD

Affiliation: Emory University School of Medicine, Atlanta, Georgia.

Purpose: Extracorporeal Shockwave Therapy (ESWT) is a promising modality in the treatment of musculoskeletal issues due to the ability to treat various conditions across multiple tissue types. The current study aims to compare patient satisfaction after ESWT in the treatment of tendon versus bone pathologies.

Methods: Forty-one patients undergoing ESWT for tendon and bone pathologies were identified through retrospective chart review. Patient demographics, number or ESWT treatments, and reported outcome at last follow-up visit were recorded. A cross-sectional patient satisfaction survey was distributed to patients at a time point >3 months after their last ESWT treatment to evaluate mid-term outcomes and satisfaction.

Results: Forty-one patient encounters were identified in the study period (19 M, 22 F, mean age 52 y/o, range 17-80 y/o). Thirty-seven patients underwent ESWT treatment for tendon pathologies, compared to 4 patients for treatment of bone pathologies. From chart review, 32/37 (86%) tendon pathology patients reported improvement at their follow-up. In the

5/37 (14%) with no improvement, there was no significant difference in number of ESWT treatments. Conversely, 3 of 4 of patients treated for bone issues reported no improvement after treatment. Mid-term outcomes were assessed at a time-point >3 m following treatment with Global Health Question and Patient Satisfaction scales. Eight patients responded to the survey thus far. For the Global Health Question, the mean score for tendon pathology patients was 78/90 compared to a mean score for bone pathology patients of 46/90. Patient Satisfaction scales demonstrated a mean rating for tendon pathologies of 6/7 compared to a mean outcome score for bone pathologies of 3/7.

Conclusions: The present data suggest that both short-term response and mid-term outcomes of ESWT for tendon pathologies was superior in comparison to bone pathologies. There was no difference between number of ESWT and treatment response in either condition. In patients >3 months out from last ESWT treatment, there was higher mean satisfaction in treatment of tendon pathologies in both the Global Health Questions and Patient Satisfaction scores.

Significance: ESWT is a promising modality in the treatment of difficult musculoskeletal pathologies. Defining treatment results and patient satisfaction after ESWT across different conditions is important when counseling patients about their treatment options.

TOPIC: Education

STUDY: Survey

Knowledge of Antibiotic Resistance in Athletic Trainers (KARAT)

Primary Author/Presenter: Tu Dan (Kathy) Nguyen, MD, CAQSM

Garrett Dennis, BS, Patrick Prazak, MD, Jude des Bordes, MBChB, MPH, DrPH, CPH, and Rehal Bhojani, MD

Affiliations: Memorial Family Medicine Residency Program, Sugar Land, Texas; and McGovern Medical School at the University of Texas Health Science Center, Houston, Texas.

Purpose: To determine athletic trainers' knowledge regarding proper antibiotic prescription & antibiotic resistance to avoid improper use of antibiotics amongst athletes. This data can then be used to identify knowledge gaps that can be supplemented to minimize the use of antibiotics in the training room.

Methods: Cross-sectional study utilizing a questionnaire adapted from a survey administered to the American public on antibiotic resistance. It was tailored to athletic trainers and focused on the appropriate use of antibiotics & patterns of antibiotic resistance in the training room. Questionnaire utilized a 5-pt. Likert Scale & yes/no responses. Data used to determine knowledge gaps for future education.

Results: Digital survey sent to 969 athletic trainers in the Houston area. Sixty-three responses received. 33 were 20 to 39 years old, 30 from 40+ age group. Thirty-two male, 31 female. Fifty-two white, 11 black, 1 Asian. Twenty-five had bachelor's degree, 38 with master's, 1 with a doctorate. Forty-two works high school sports, 16 collegiate, 6 professional. Sports covered were varied. Of the 63 respondents, 5 had formal antibiotic use training, 59 had no training. Responses were compared to look for areas with large discrepancy. Amongst the survey responses, stand outs include: 4.7% did not think antibiotic resistance is a significant problem, 28.1%

were neutral, 67.2% agreed. 21.9% disagreed with “we will lose the ability to use antibiotics in the future if preventative measures are not taken to prevent resistance,” 32.8% neutral, 45.3% agreed. 46% disagreed with “limiting the of prescription of antibiotics will cause more harm than good,” 30.2% neutral, 23.8% agreed. When asked if antibiotics can kill viruses, 6.3% agreed.

Conclusions: In 2019, the CDC reported that antibiotic resistance contributes to 1 death every 15 minutes. Additionally, antibiotic resistance accounts for \$20 billion in health-care costs annually. Our findings show significant discrepancies in antibiotic use and resistance knowledge, indicating a need for formal education. ATs are the first point of contact to our athletes so educating them on proper use may reduce unnecessary antibiotic prescriptions.

Significance: The information gathered from the survey indicates a need for antibiotic education in the training room to prevent antibiotic resistance in our athletic population. Part 2 of our research will be to send out education and re-evaluate with a survey.

References

1. Habboush Y, Guzman N. Antibiotic Resistance, In StatPearls: Treasure Island, FL, 2022.
2. Prevention, C.f.D.C.a. Antibiotic resistance threats in the United States, 2019. 2019.
3. Ventola CL. The antibiotic resistance crisis.
TOPIC: Education
STUDY: Survey

Assessing Medical Student Volunteers Who Worked With Medically Underrepresented Populations at 'A Day in Sports Medicine'

Primary Author/Presenter: Andrew S. Nowak, JD

Gabrielle Kennelley, MS, Brittany Hamama, BS, Kayla Johnson, BS, Chin-I Chang, PhD, and Noshir Amaria, DO, AT, ATC, CAQSM

Affiliation: Central Michigan University College of Medicine, Mt. Pleasant, Michigan.

Purpose: To assess the effects of exposure to both Native American and other medically underrepresented adolescents, as well as to the various health professions on the sports medicine team, on medical students volunteering with “A Day in Sports Medicine.”

Methods: In this pilot study, volunteers took a pre-event survey to assess their understanding of and motivation for joining a sports medicine team in the future, and to evaluate if they had previously worked with individuals from any Native American Tribes. Students later took a similar post-event survey regarding the sports medicine team to assess for any changes. All surveys were completed online.

Results: Between pre- and post-event surveys, 2 questions were of interest: Q1. On a scale of 1 to 5 (1 = lowest score and 5 = highest score), please rate your understanding of the roles/responsibilities of healthcare professionals that comprise the sports medicine team. Q2. On a scale of 1 to 5 (1 = lowest score and 5 = highest score), please rate your motivation for a future career in sports medicine. Between the pre-and post-surveys for Q1, a rating of 2 decreased from 33% to 0%, rating of 3 from 44% to 14%, rating of 4 from 22% to 43%, rating of 5 from 0% to 43%. For Q2, rating of 2 decreased from 33% to 0%, rating of 3 from 11% to 29%, rating of 4 from 44% to 29%, and rating of 5 from 11% to

43%. Also, 100% of mentors had no prior experience working with students from Native American Tribes and 100% of mentors responded “Likely” or “Very Likely” to volunteering in their community to enhance access to educational activities related to healthcare for underrepresented students after this event.

Conclusions: These results suggest events like “A Day in Sports Medicine” provide opportunities for medical students to work with medically underrepresented adolescents while also furthering their knowledge regarding the roles/responsibilities of various health professions on a sports medicine team. Such exposure may foster interest in serving medically underrepresented individuals and providing adequate resources and mentorship throughout medical training.

Significance: Volunteering with medically underrepresented adolescents in specific areas of medicine may influence medical student career paths and desired patient populations. Future studies will aid in the further evaluation of these impacts.

Acknowledgments: The investigators would like to thank the AMSSM for the Agostini Medical Student Community Outreach Grant, Dr Noshir Amaria, our faculty advisor, and the Mid-Central Area Health Education Center (AHEC).

TOPIC: Concussion

STUDY: Cohort

Does On-site Evaluation of Clearance Reduce Delay in Return to Play for Athletes Recovered From Concussion?

Primary Author/Presenter: Victoria Nutting, DO

Meredith Williamson, PhD, Stephen Line, DO, Shanice Chedi, MS, Elizabeth Nguyen, MD, Laura Marsh, MD, William Taylor Payne, MD, and William Zachary Payne, BS

Affiliation: CHI St. Joseph's Hospital, Bryan, Texas.

Purpose: The purpose is to determine if having a designated on-site team physician to clear asymptomatic athletes with previous concussions will reduce delay in return to play compared to concussion clearance in a traditional off-site setting.

Methods: All athletes who suffered concussions from football in a single season on a single high school football team were included. Data points include setting of evaluation and number of days awaiting clearance once deemed asymptomatic per the athletic trainer. The location options are on site at the school versus off-site, which includes but is not limited to a physician's office, ER, or urgent care.

Results: The athletes were divided into 2 equal groups for this study. Two athletes with concussions were seen off-site in a physician's office. These athletes had an average of 6 days while they were asymptomatic waiting to be cleared. Two athletes were evaluated by an on-site by a physician at the school. They had an average of 2 days while they were asymptomatic waiting to be cleared. On-site physician evaluations result in the shortest delay in evaluation of recovered asymptomatic athletes. Concussion clearance examination by a team physician on-site allows athletes to return to play more quickly.

Conclusions: Asymptomatic athletes who recovered from a concussion evaluated on site by a physician had a reduced delay in return to play compared to athletes evaluated in the traditional setting of a physician's clinic. Athletes cleared on-

site would inevitably result in fewer unnecessarily missed practices and games. This study is limited by a small sample size. It can be reasonably assumed that the results would translate to a larger sample size.

Significance: A team physician evaluating athletes on-site allows for faster return to play. This may benefit remote, underserved schools with less access to city centers with physician's clinics. This study advocates for the expansion of on-site team physicians.

Acknowledgments: Snook High School Coach Dylan Conway Texas A&M Sports Medicine Fellowship.

TOPIC: Epidemiology

STUDY: Other

Epidemiology of Treadmill Related Adverse Events in the Elderly: A 10-Year Analysis of the NEISS

Primary Author/Presenter: Sharon Ong, MD

Ziva Petrin, MD

Affiliation: Rutgers New Jersey Medical School, Newark, New Jersey.

Purpose: Treadmills continue to gain popularity as gym and home exercise equipment. Recently reported injuries in the pediatric population have resulted in commercial recalls due to safety. The aim of the study was to evaluate adverse events resulting from treadmill use in the elderly.

Methods: The National Electronic Injury Surveillance System (NEISS) was queried for records on individuals 65 years and older over a 10-year period (January 2012–December 2021). An initial query using product code 3277 (Exercise equipment) was subsequently analyzed for injury associated specifically with treadmill use. Descriptive data analysis was performed for diagnosis and outcomes.

Results: A total of 2583 individuals over age 65 captured in NEISS had an adverse event associated with exercise equipment, for a national estimate of 120507 cases, CV 0.14 and 95% CI (87517, 153495). Of these, 1137 were related to treadmill use, with mean age of 75 years, range 65 to 101 years of age. 46% were male and 54% female. Cardiac chest pain represented 18% of treadmill associated cases, 67% of which were in males versus 33% in females. 46% of all cases were the result of a fall on the treadmill. Contusions were the most common type of injury (17%), followed by internal organ injury (12%) and fracture (9%). The head was the most commonly injured body part (13%), followed by face (9%), shoulder (5%) and knee (5%). 70% of injuries were treated in the Emergency Department and released, while 25% required hospitalization. Although fatal cases were rare, 80% were due to cardiac arrest, of which all were male, and 20% were due to head injury from a fall.

Conclusions: Nearly half of treadmill-related events in the elderly were due to fall, with the head being the most common location of injury. A significant proportion of treadmill-related adverse events in the elderly were due to cardiac events. A quarter of all cases resulted in hospitalization.

Significance: Education on safe use of treadmills targeted to the elderly is needed based on the results of this study. This should include information for individuals with increased fall risk as well as additional focus on cardiac risk assessment and education.

TOPIC: COVID-19

STUDY: Survey

The Impact of Physical Activity on COVID Infection Severity

Primary Author/Presenter: Deborah Pacik, MD, MPH

Erica Kwong, MD, Arielle Farhi, MD, Samantha DiSalvo, Zeus Castro, MD, Bari Madureira, DO, MPH, Anne Ambrose, MD, MS, and Matthew Bartels, MD, MPH

Affiliation: Icahn School of Medicine at Mount Sinai, New York, New York.

Purpose: The purpose of this pilot study was to determine the effect of regular physical activity prior to COVID infection on disease severity in an urban setting with high rates of poverty and limited access to recreation due to safety concerns and lack of transportation.

Methods: Eighty-seven participants admitted to an acute care hospital with COVID from March to August 2020 were interviewed using the International Physical Activity Questionnaire (IPAQ). Level of physical activity was correlated with disease severity, length-of-stay, and disposition using SPSS 27. Additionally, the impact of co-morbidities, BMI, age, race, gender, and poverty were incorporated into the analysis.

Results: Thirty (34.5%) of the participants scored at the lowest level of physical activity. Twenty-three (26.4%) performed moderate weekly activity. Thirty-four (39.1%) were in the highest category of physical activity. There were 69 people with moderate disease and 18 people with severe infections. There was no statistically significant difference between the levels of physical activity and severity of infection. Length-of-stay and disposition had similar results. In our group, 6 (7%) participants had no co-morbidities, 15 (17%) had 1 co-morbidity, and 66 (76%) had 2 to 6 co-morbidities. The mean BMI was 32 and the mean age was 57. 51.7% were black, 26.4% were Hispanic, and 11.5% were white. There were 45 (51.7%) women in the study. More than half (53%) were at or below the poverty line.

Conclusions: Our study found no significant impact of physical activity on COVID severity. Other studies have shown that activity can decrease severity of infection. We show that poverty and co-morbidities likely have a greater impact on infection severity than physical activity. Another crucial difference between the studies is insurance coverage. In our urban area, 12% of the population has no insurance and 42% have Medicaid or other public insurance.

Significance: Our study shows that poverty, co-morbidities, and possibly insurance coverage likely has a stronger effect on COVID disease severity than physical activity.

Acknowledgments: Marjorie Morales, MD Olivia Kralik Kevin Tang Harnadar Anand Cecilia Cordova, MD Yungtai Lo, PhD.

TOPIC: Other

STUDY: Survey

Perceptions and Beliefs of Football Coaches Regarding the Merits of Youth Tackle Football

Primary Author/Presenter: Adam Pfaller, MD

Timothy McGuine, PhD, Alison Brooks, MD, MPH, Alison Schwarz, BS, Kevin Biese, PhD, Mayrena Hernandez, PhD, Sam Mosiman, MS, and John Wilson, MD, MS

Affiliation: University of Wisconsin-Madison, Madison, Wisconsin.

Purpose: Youth football proponents say it teaches athletes safe blocking and tackling techniques to set up for high school

success. Opponents say injury risk, including concussion, is too high. The study compares the beliefs of high school and youth coaches regarding benefits of youth tackle football.

Methods: Head varsity high school football coaches (HSC) in Wisconsin and youth coach (YC) members of the Wisconsin Football Coaches Association were asked to complete a survey regarding youth football. Responses for both groups were compared with χ^2 and Fisher's Exact tests.

Results: Two hundred thirty-eight of 392 (61%) HSC and 140 of 405 (34.5%) YC completed the survey. YC were more likely to agree or strongly agree that youth should play tackle football before grade 6 than HSC (YC = 61.3%, HSC = 12.1%, $P < 0.001$) while HSC were more likely to believe that players should not play tackle football before high school (HSC = 31.5%, YC = 0.0%, $P < 0.001$). YC were more likely to agree or strongly agree that tackle football in grades 3 to 5 (YC = 63.1%, HSC = 10.0%, $P < 0.001$) and grades 6 to 8 (YC = 92.1%, HSC = 58.4%, $P < 0.001$) were important to teach safe football skills. YC were more likely to agree or strongly agree that tackle football in grades 3 to 5 (YC = 50.0%, HSC = 5.4%, $P < 0.001$) and in grades 6 to 8 (YC = 73.2%, HSC = 30.3%, $P < 0.001$) would reduce a players' risk of injury playing in high school. HSC were less likely to agree or strongly agree that participating in youth football would make players more likely to succeed in high school football (HSC = 13.0%, YC = 72.2%, $P < 0.001$).

Conclusions: YC, compared to HSC, were more likely to believe that youth players benefited from playing youth tackle football for learning safe football skills, reducing high school injury risk, and for greater football success in high school. The disparities were greater for grades 3 to 5 than grades 6 to 8. Most HSC (87%) did not strongly agree or agree that youth football participation was necessary for high school success.

Significance: Large differences in perceptions between HSC and YC exist about the benefits of youth tackle football, especially for grades 3 to 5. Further research should look into whether early participation increases success or decreases subsequent injury risk.

Acknowledgments: We would like to thank all of the coaches that participated in this study.

TOPIC: Other

STUDY: Other

Point of Care Ultrasound Evaluation of Fluid Status in Ironman Medical Tent

Primary Author/Presenter: Shannon Philipps, DO, MS

Bashyam Iyengar, MD, Danielle Carter, MD, Sagar Shahani, DO, Jonathan Carbungco, DO, and Joe Bhagratie, DO

Affiliation: Ascension Resurrection Sports Medicine, Chicago, Illinois.

Purpose: To investigate if point of care ultrasound evaluation of intravascular volume assessment can be used to guide decision making points in exercise associated hyponatremia particularly in emergency situations where laboratory supplies are not readily available.

Methods: This is a prospective observational study which took place at the Ironman Florida 2022. We measured athlete weight within 3 days of their participation in Ironman Florida 2022 at the pre-race expo. We then measured their weight again after the race and performed an evaluation of their

maximum dIVC and IVC CI and compared the relationship between the change in weight and dIVC and IVC CI.

Results: The data consisted of 33 cases with completed phase 2 inputs. One case was excluded from the analysis for having an outlying weight loss of 88.5 lbs. This may have been an entry error. Twenty-eight percent reported NSAID use. 21.9 percent reported symptoms. 40.6 percent had a positive Sniff test. There was no significant correlation found between collapsibility index (CI) and change and weight ($r = 0.016$, P value 0.932). There was an expected, large correlation between CI and diameter size ($r = \text{neg } 0.935$, P value less than 0.001), likewise, there was a slight correlation between smaller diameter and increased compressibility ($r = 0.337$, P value 0.060). Thirteen athletes had a positive sniff test, which was 40% of those who completed phase 2 of the trial. There was no correlation with the sniff test and compressibility.

Conclusions: While there was no significant correlation between collapsibility index (CI) and change and weight in Ironman athletes, this study was limited by sample size. A larger sample size is needed to examine the relationship between CI and weight change when controlling for BMI and gender. More participants are needed to examine if there is a statistically significant correlation between positive symptoms and compressibility.

Significance: POCUS has potential to be a useful tool for evaluation of intravascular volume assessment in exercise associated hyponatremia. More research is needed to determine its utility in guiding decision-making treatment points for EAH when supplies are low.

Acknowledgments: Ascension St. Vincent's Family Medicine Residency Program Ironman Florida Staff Ironman Athletes.

TOPIC: Pediatrics

STUDY: Other

Throwing Shoulder Total Range of Motion and Hamstring Flexibility in Adolescent Baseball Players

Primary Author/Presenter: Davong David Phrathep, MS

Jayden Glover, BS, Steven Fischer, BS, Brandon Valls, BS, Jonathan Nguyen, BS, and David Boesler, DO

Affiliation: Lake Erie College of Osteopathic Medicine, Bradenton, Florida.

Purpose: Current literature emphasizes the effects of hamstring inflexibility and throwing shoulder total ROM in adult baseball players. We aim to identify the association between the contralateral hamstring flexibility and throwing shoulder total range of motion in adolescent baseball players, specifically.

Methods: Fourteen high school varsity baseball players volunteered for the study. Bilateral hamstring and throwing shoulder total ROMs were measured using a goniometer by the same examiner. Contralateral hamstring flexibility was measured using the popliteal angle test. These measurements were compared to the throwing shoulder total ROM using a linear regression analysis.

Results: The correlation coefficient, r , was +0.3928, indicating a moderate positive linear relationship. Repetition and stress load on the shoulder throughout the entire throwing motion in baseball can lead to shoulder injuries. The stride position helps transfer energy from the lower extremity to the throwing shoulder by allowing proper trunk positioning. Lead hamstring inflexibility limits stride length and decrease force

development by reducing trunk rotation potential. Restricted hamstring ROM places additional stress on the throwing shoulder and increase the risk of injury. We conclude that higher contralateral hamstring-popliteal angles may cause a compensatory increase in throwing shoulder total ROM, which may increase the risk for shoulder injuries.

Conclusions: Overhead throwing athletes with limited hamstring flexibility should be counseled appropriately regarding their risk for shoulder injury. Baseball players should stretch and prepare their bodies to throw to reduce the compensatory mechanisms that may occur from hamstring inflexibility. We highlight the role hamstring inflexibility may play in shoulder injury development in adolescent baseball players.

Significance: We highlight the importance of hamstring stretching, training, and recovery in youth throwing athletes. Our study determines how hamstring inflexibility can increase the risk for throwing shoulder injury development in adolescent baseball players.

Acknowledgments: Thank you to the Lakewood Ranch High School baseball team for participating in this study.

TOPIC: Musculoskeletal

STUDY: Other

Do Trainees Cause More Injection-Related Pain: A Pilot Study of 468 Patients

Primary Author/Presenter: Sarah Pietruszka, MD, DPT

Caitlin Faust, BS, Joy English, MD, Nicholas Monson, DO, Christopher Gee, MD, MPH, Emily Harold, MD, Mark Sederberg, DO, and Daniel Cushman, MD

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

Purpose: Medical procedural training typically relies on an apprenticeship model, with an experienced physician overseeing trainees as they perform hands-on tasks. To date, no studies have evaluated the effect of trainee involvement on patient-reported pain of the procedure.

Methods: Patients were recruited from 2 orthopaedic sports medicine clinics from August 2021 to January 2022. Injections were performed in a standard-of-care manner with fellowship-trained attending physicians performing injections with or without trainees, per their teaching schedules and comfort levels. Patient-reported procedure-related pain was asked after the physicians left the room.

Results: A total of 420 patients were included in the analysis. Trainees performed 73 (17.3%), observed 63 (15.0 %), and were not present for 284 (67.6%) injections. Fellows were involved in 95.6% of these injections. The patients were 62.4% female, aged 60 ± 15 years. Ultrasound guidance was used in 83.1% of procedures, which consisted of 67.1% joint, 19.7% peri-tendinous, and 13.9% other injections. Local anesthetic was used in 92.3% of all injections. The presence of a trainee for the procedure (performed or observed) was not associated with increased painfulness of the procedure with univariate linear regression analysis ($P = 0.878$), nor was there an association of a trainee performed the procedure ($P = 0.407$).

Conclusions: Properly-supervised sports medicine fellows do not appear to cause any additional pain in musculoskeletal injections. Larger cohorts may identify more subtle findings; there may be differences in fellows' prior experience and in teaching style.

Significance: Sports medicine fellows can provide injections without increased discomfort to the patients. Differences in fellow experience and teaching methods may alter these results.

Acknowledgments: Thank you to Dr Masaru Teramoto, PhD, MPH, PStat for his invaluable contributions to this study.

TOPIC: Musculoskeletal

STUDY: Other

Which Factors Relate to Patient-Reported Procedural Pain With Injection: A Pilot Study

Primary Author/Presenter: Sarah Pietruszka, MD, DPT

Daniel Cushman, MD, Caitlin Faust, BS, Joy English, MD, Christopher Gee, MD, MPH, Emily Harold, MD, Mark Sederberg, DO, and Masaru Teramoto, PhD, MPH, PStat

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

Purpose: Interventional pain control through diagnostic and therapeutic injections has recently grown exponentially in practice. Few studies have explored pain related to musculoskeletal injections. This study explores what patient- and injection-related factors contribute to a patient's perception of pain.

Methods: Injections were performed in a standard-of-care manner by sports medicine physicians with fellowship training on patients from 2 orthopaedic sports medicine clinics over a 4-month period. Following their procedure, patients reported their procedure-related pain after the physicians left the room.

Results: This analysis included 495 patients. The patients were 62.4% female, aged 60 ± 15 years with a BMI of 29.4 ± 7.52 kg/m². Ultrasound guidance was used in 83.1% of procedures, consisting of 67.1% joint, 19.7% peritendinous, and 13.9% other injections. Local anesthetic was used in 92.3% of all injections, buffered with sodium bicarbonate in 38.9%. 71.9% of anesthetic and 41.5% of injectate injections used a 25-gauge needle. Univariate analysis revealed that sex, image guidance, sodium bicarbonate, joint size, age, BMI, pre-procedural pain, post-procedural pain, and injectate volume may be related to intra-procedure pain. Variables with significance of $P < 0.20$ were included in the final multivariate logistic regression model. Multivariate analysis found that male sex ($P = 0.004$), lower BMI ($P = 0.021$), and addition of sodium bicarbonate ($P < 0.001$) were associated with reductions in patient-reported pain.

Conclusions: Injections are commonly performed as diagnostic and/or therapeutic interventions in sports medicine. This study found that female sex, higher BMI, and lack of buffering in local anesthetic were associated with a statistically significant increase in patient-reported pain.

Significance: Understanding what modifiable and non-modifiable factors influence pain in sports medicine patients will improve counseling and ideally lead to a reduction of experienced pain.

Acknowledgments: Thank you to Dr Nicholas Monson for his contributions to this study.

TOPIC: Concussion

STUDY: Cohort

Risk of Lower Extremity Injury Following Concussion in the National Football League

Primary Author/Presenter: Margot Putukian, MD, FAMSSM
Alexandra Chretien, MPH, Erin Wasserman, PhD, Kim Harmon, MD, Javier Cardenas, MD, Gary Solomon, PhD, David Okonkwo, MD, and Christina Mack, PhD

Affiliation: Major League Soccer, NY, NY Internal Medicine/Sports Medicine, Princeton, New Jersey.

Purpose: Literature on injury risk after concussion is mixed, with varied results based on design, comparison group, and outcome (timing/injury type). This study examined whether National Football League (NFL) players had increased risk of lower extremity (LEX) sprain, strain, or fracture after concussion.

Methods: This retrospective study analyzed time to LEX injury among players concussed in 2015 to 2021 pre- or regular season NFL games compared to (1) players participating in the same game, and (2) players who sustained a missed time upper extremity injury in the study period. Cox Proportional Hazards models adjusted for prior-year injuries, tenure, and position, and accounted for days missed due to injury.

Results: The hazard of LEX injury was 11% higher among concussed NFL players compared to non-concussed players from the same game; however, this relationship was not statistically significant (HR = 1.11, 95% CI: 0.89-1.39). Without accounting for time missed due to injury among concussed players, the relationship strengthened (HR = 1.23, 95% CI: 0.99-1.52). Compared to players with a missed time upper extremity injury, the hazard of a missed time LEX injury was 26% lower among concussed players (HR = 0.74, 95% CI: 0.56-0.98); this ratio did not change when days missed due was included as a covariate, suggesting the use of an injured comparison group who were removed from play during recovery methodologically accounts for confounding. Results were largely consistent across follow-up times, with slightly stronger associations in the 30 days immediately following the index event.

Conclusions: There was not a statistically significant increased risk of LEX injury following concussion among NFL players. Using an injured comparison group produced different results than an all-player comparison group and controlling for days missed also influenced results, suggesting that observed increased subsequent injury risk may be related to days missed from training and deconditioning rather than neurocognitive effects.

Significance: When examining risk of injury following concussion, comparison group, follow-up time, and controlling for potential confounders meaningfully impacts results; neurocognitive effects of concussion may not increase risk of subsequent injury.

Acknowledgments: The authors thank the NFL athletic trainers for diligent reporting of NFL player injuries. The authors also appreciate the cooperation of the NFL Players Association in the completion of this study, and the support of the NFL Head, Neck, and Spine Committ.

TOPIC: Cardiology

STUDY: Other

Does My Athlete Have Hypertension

Primary Author/Presenter: Quraish Rababah, MD

Amala Chako, MD and Robert Lichtenberg

Affiliation: Edward Elmhurst Health, Elmhurst, Illinois.

Purpose: The normal BP levels for ages 15 to 17 who are >72.5 in, per the normative data published by AAP, fall above the ACC/AHA and the AAP level for stage 1 HTN diagnosis. The question is, why is height not taken into account when diagnosing hypertension despite data showing higher BP in taller 15 to 17 yo?

Methods: We performed pre-participation screening on the local men's junior college Volleyball team. Of 14 members, ages 17 to 20, 7 were >74 inch tall. Four had SBP > 130 mm Hg. All were provided oscillometric machines for home monitoring.

Results: Four of 7 had mean SBP > 130 but <135 mm Hg and DBP < 80 mm Hg. Per normative BP data for height >72.5 inches, these 4 would not be diagnosed with hypertension. However, they would be per ACC/AHA guidelines.

Conclusions: Guidelines for sports participation in the setting of hypertension, state that participation should not be limited; however, recommend BP measurements every 2 to 4 month. To label athletes taller than 72.5 inches whose BP is >130 mm Hg with stage 1 hypertension goes against normative data for similar aged athletes.

Significance: Guidelines recommend monitoring BP every 2 to 4 months in these athletes. No data supports this monitoring. How long this extends into adulthood remains to be determined. Guidelines do not address height, posing a problem for taller athletes and doctors.

Acknowledgments: Special thanks to all athletes who participated in the study.

TOPIC: Other

STUDY: Other

Microvascular Architecture Assessment in Rock Climbers by Nailfold Capillaroscopy

Primary Author/Presenter: Quraish Rababah, MD

Eliza Pierko, MD and Genesis Maldonado, MD

Affiliation: Edward Elmhurst Health, Elmhurst, Illinois.

Purpose: Studies have shown that rock climbing causes structural changes in fingers like bone and joint hypertrophy. It is unknown if it causes vascular changes. The purpose of this study is to determine the microvascular alterations and describe a pattern in rock climbers.

Methods: Observational, descriptive and prospective study of healthy rock climbers. Participants were stratified based on The International Rock Climbing Research Association's (IRCRA) ability grouping scale. Capillaroscopy was performed with G4-capillaroscope in the fourth and fifth digit of the non-dominant hand. Images were analyzed by Capillary.Io software. Data analysis was performed using SPSS v29.

Results: Thirty climbers, 70% advanced, 28% intermediate, 3% elite. Visibility was good in 80%, poor in 20%, architecture normal in 57%, altered in 43%, Density very good in 23%, good in 63%, decreased in 13%. Apical diameter mean was $37.89 \pm 6.9 \mu\text{m}$. Giant capillaries present in 17%, hemorrhages 10% and SD pattern 10%. IRCRA intermediate group presented an abnormal architecture in 50%, advanced group 62% and elite 100%. DENSITY in intermediate group was very good in 12.5%, good in 75%, reduced in 12.5%, advanced group very good in 24%, good 62%, reduced in 14%, elite good in 100%. Mean apical diameter in intermediate group was $37 \pm 7.5 \mu\text{m}$, advanced 37.4 ± 6.4 , elite 51.4. Presence of avascular areas in the

intermediate group was 12.5%, 24% in advanced, 0% in elite. Ramified capillaries in 25% intermediate, 33% advanced, 100% in elite.

Conclusions: No statistical significance between the presence of giant capillaries, hemorrhages, SD-pattern among IRCRA groups. Participants presented a normal architecture in 57%, the characteristic pattern was ectasias, tortuous and crosslinked capillaries.

Significance: This is the first preliminary study describing nailfold capillaroscopic patterns among rock climbers. More data needs to be collected to assess further differences among ICRA groups.

Acknowledgments: The authors are grateful to all climbers who participated in the study and to the staff at Movement Gym Lincoln Park, Chicago, IL, for their help.

TOPIC: Musculoskeletal

STUDY: Cohort

The Association of Developmental Stage and Injury Type in a Clinical Population of Youth and College Athletes

Primary Author/Presenter: Mario E. Ramirez, BS

Stephanie Logterman, MD, Ally Render, BS, Caleb Truong, Stacey Schley, MD, Jeffrey Webb, MD, and Neeru Jayanthi, MD

Affiliations: Medical College of Georgia, Augusta, Georgia; and Emory Sports Medicine Center, Atlanta, Georgia.

Purpose: This clinical study's purpose is to determine whether youth and college athletes are at risk to sustain different injury types (acute vs overuse vs serious overuse) during their developmental stages of skeletal maturity as measured by percentage of predicted adult height (PPAH).

Methods: PPAH-at-injury calculation by the Khamis-Roche method and injury categorization via electronic medical records were completed for consented athletes aged 10 to 23 seen in a sports medicine clinic. Athletes were stratified into groups relative to peak-height-velocity (PHV): pre-PHV < 85%, circa-PHV 85% to 95%, and post-PHV ≥ 96%. Exact χ^2 testing evaluated the PPAH and injury type association.

Results: At the time of submission there were 329 athletes eligible for analysis of 359 enrolled, with 190 (57.8%) male, 139 (42.2%) female, mean age 15.5 years old, and mean PPAH 95.1%. There were 154 (46.8%) acute injuries of which 42 (12.8% overall) were concussions, and 175 (53.2%) overuse injuries of which 50 (15.2% overall) were considered serious overuse injuries. There were 25 (7.6%) pre-PHV athletes, 107 (32.5%) circa-PHV athletes, and 197 (59.9%) post-PHV athletes. There was a significant association between developmental stages by PPAH and injury types ($P = 0.050$): Pre-PHV athletes had a high rate of (64%) overuse injuries with only 1 serious overuse injury, while circa-PHV athletes had (60.7%) overuse injuries with 18 serious overuse injuries. Post-PHV athletes had (47.7%) overuse injuries, but with 31 serious overuse injuries, and a higher rate of (52.3%) acute injuries.

Conclusions: Youth athletes are more likely to sustain certain injury types at different stages of development of skeletal maturity according to PPAH. Athletes at the pre-adolescent developmental stage (pre-PHV) were more likely to sustain overuse injuries, but less likely to sustain acute or

serious overuse injuries. Athletes with skeletal maturity (post-PHV) were more likely to sustain acute or serious overuse injuries.

Significance: This study shows the utility of PPAH as a developmental tool for injury type risk assessment in a clinical youth athlete population. It identifies athletes at risk for overuse and serious overuse injuries for age-appropriate training load management.

Acknowledgments: Funding provided by the Emory University Department of Orthopedics Intramural Seed Grant.

TOPIC: Musculoskeletal

STUDY: Cohort

Difference in Treatment Response Between Insertional and Non-Insertional Achilles Tendinopathy Following Shockwave Therapy

Primary Author/Presenter: Hye Chang Rhim, MD, MPH

Molly McCormack, BA, Jonathan Fee, BS, Kevin Vu, MD, Ashley Gureck, MD, and Adam Tenforde, MD

Affiliation: Department of Physical Medicine and Rehabilitation, Harvard Medical School, Spaulding Rehabilitation Hospital, Boston, Massachusetts.

Purpose: The purpose of this study was to investigate whether there was a difference in treatment response between insertional and non-insertional Achilles tendinopathy (AT) following extracorporeal shockwave therapy (ESWT).

Methods: A retrospective chart review was conducted for all patients who received ESWT for management of AT at one outpatient sports medicine clinic from 2017 to 2022. Demographic and clinical characteristics as well as patient-reported functional outcome measured by Victorian Institute of Sports Assessment-Achilles (VISA-A), were extracted.

Results: Final sample included a total 81 patients, 33 patients with insertional AT (mean age of 43.6 and mean BMI of 25.6) and 48 with midportion AT (mean age of 46.9 and mean BMI of 24.4). All 10 patients who demonstrated Haglund's deformity or retrocalcaneal bursitis had insertional AT. Both types of AT showed a significant change in VISA-A score following a minimum of 3 ESWT treatments (insertional AT, initial mean VISA-A 50.9, final mean VISA-A 65.3, P -value < 0.001; midportion AT, initial mean VISA-A 48.0, final mean VISA-A 72.4, P -value < 0.001). Multiple linear regression demonstrated that a change in VISA-A score in patients with non-insertional AT was on average 10.7 points higher than those with insertional AT after controlling for age, gender, BMI, symptom duration, type of ESWT, total number of ESWT, and follow-up length.

Conclusions: ESWT combined with eccentric exercises resulted in significant functional improvement in patients with AT. However, patients with non-insertional AT may respond to these treatments more favorably than those with insertional AT. One possible explanation for this difference may derive from concomitant Haglund's deformity or retrocalcaneal bursitis in patients with insertional AT.

Significance: While ESWT can be helpful in both types of AT, this study controlled for various demographic and clinical characteristics and found that patients with insertional AT may have less treatment response compared to those with non-insertional AT.

TOPIC:

STUDY: Cohort

Assessing Brain Neurophysiology With P300 Evoked Response Potentials in Long COVID Patients With Prolonged Cognitive Fatigue

Primary Author/Presenter: Daniella Rivera, MS

Mo Mortazavi, MD, Taylor Seitz, Dave Oakely, PhD, Francesca Arese, PhD, and Leslie Streeter, DNP

Affiliation: School of Osteopathic Medicine in Arizona, A.T. Still University, Mesa, Arizona.

Purpose: To evaluate brain neurophysiology of patients with cognitive (cog) fatigue from long COVID utilizing quantitative electroencephalography (qEEG) P300 evoked response potentials (ERP).

Methods: Retrospective review of 13 long COVID patients, ages 13 to 66 (avg 42), with average (avg) of 8 months from COVID infection were evaluated with qEEG P300 ERPs at a brain injury center. Brain neurophysiology was evaluated with qEEG technology utilizing an audio oddball P300 protocol. Symptom burden and profiles were also tracked with the Concussion Clinical Profiles screening tool (CP screen).

Results: Cohort P300 ERP latency (P300T), P300 ERP voltage (P300V), P300 avg central parietal voltage (P300I), and brain map coherence were measured. Age (SD) = 42(12), normative reference range: 45 (5). P300T (SD) = 299 (52) milliseconds, normative reference range: 290 (35) milliseconds. P300V (SD) = 8.84 (4.7) uV, normative reference range: 13 (5) uV. P300I (SD) = 5.53 (3.19) uV, normative reference range unavailable. Coherence (SD) = 6(5), normative reference range: 3 (1). A significant difference was seen in P300 voltage and coherence with diminished P300V ($P = 0.01$, Cohen's D effect 0.9) and increased coherence ($P = 0.01$, Cohen's D 0.6) for the cohort over control group. There was no difference in P300T between groups. The CP screen total symptom score average was 30/89, with cognitive fatigue as predominant profile (avg 1.8/3).

Conclusions: Although traditionally utilized in neurodegenerative and brain injury patients with persistent cognitive deficits, P300 ERPs in long COVID patients with predominantly cognitive complaints demonstrated abnormal results. Specifically, significantly suppressed P300 ERPs were noted along with elevated coherence.

Significance: The utilization of P300 ERPs to assess brain neurophysiology and cognitive resources as they relate to cognitive symptom burden in Long COVID may be a useful objective tool in quantifying cognitive fatigue and establishing targeted therapies.

Acknowledgments: SPARCC. Sports Medicine, Rehabilitation and Concussion Center.

TOPIC: Training

STUDY: Cohort

Effects of Sports Specialization on Mental Health and Injury Rates in Dancers

Primary Author/Presenter: Benjamin Rogers, MD

Bryan Botti, MD, Alexa Turgeman, BS, Matthew Taylor, BS, and Jeremy Close, MD

Affiliation: Thomas Jefferson University, Philadelphia, Pennsylvania.

Purpose: While previous studies have explored sports specialization in team sport athletes, there are minimal data on specialization factors for individual athletes. This study

investigated trends leading to specialization in a cohort of dancers with primary outcomes including rates of injury and burnout.

Methods: This is a prospective cohort study. Basic demographics, participation level, motivating factors for specialization, satisfaction of specialization, rates of injury, and rates of burnout, among other data, were obtained via an electronic survey. Means with standard deviation and 95% confidence intervals, t -tests, and Fisher's exact tests were performed using Stata version 17.0.

Results: There were 63 respondents, the majority of which were female ($N = 54$), mean age 19.8 years. Professional ($N = 23$), pre-professional ($N = 9$), collegiate ($N = 9$), and high school ($N = 21$) level dancers were represented. Dancers began at age 5.4 ± 3.5 years, trained 22.8 h/wk on average, and 58% ($N = 33$) played multiple sports. 69.6% (95% CI: 56.2-80.4) ($N = 39/56$) quit to specialize in dance at a mean age 10.9 and spent 10.1 months training/yr. Among the general cohort, 55.3% (95% CI: 38.9-70.5) suffered an injury attributable to dance, 77.8% (95% CI: 64.5-87.1) reported burnout, and 79.2% (95% CI: 65.9-88.2) endorsed concerns with body image. Interestingly, only 13.5% (95% CI: 6.4-26.0) of the cohort would encourage specializing in dance to their children. Among those who specialized, Fisher's exact test failed to demonstrate significant difference in burnout rate, body image concern, need for surgery, or child encouragement, between the specialized subset and the general cohort.

Conclusions: While failing to identify statistically significant association between sports specialization and our primary hypotheses, this is the first cohort study analyzing the major trends, contributing factors, and physical/psychosocial outcomes of sports specialization in a cohort of individual dancers of varying ability. Limitations include study sample size and potential for recall bias given retrospective nature of responses collected via survey.

Significance: There is a lack of data on specialization in elite dancers. Sports specialization is associated with increased rates of injury and psychological stress. Our study highlights the potential need for further investigation into this athlete demographic.

Acknowledgments: We acknowledge the support of the Thomas Jefferson University Hospital, Department of Sports Medicine.

TOPIC: Musculoskeletal

STUDY: Survey

Long-Term Outcomes of Platelet-Rich Plasma Injection With Needle Fasciotomy for Chronic Plantar Fasc

Primary Author/Presenter: Joshua Romero, MD

Christopher Thuc Ha, DO, Karina Gonzalez Carta, MD, MS, Jacob L. Sellon, MD, and Brennan J. Boettcher, DO

Affiliation: Department of Physical Medicine and Rehabilitation, Mayo Clinic, Rochester, Minnesota.

Purpose: To determine long-term pain and satisfaction outcomes after ultrasound-guided platelet-rich plasma injection with needle fasciotomy (PRP-NF) for chronic plantar fasciopathy.

Methods: A single-center, retrospective study of patients treated with PRP-NF for chronic plantar fasciopathy between June 6, 2008 and May 2, 2018 was conducted. Patient-

reported outcomes were obtained via the electronic medical record, electronic patient surveys and phone interviews. Primary outcomes were the visual analog scale for pain (VAS-Pain) and patient satisfaction ratings using a Likert scale.

Results: Twenty patients (mean age 51 ± 9 years and 17 [85%] female) were identified who underwent PRP-NF during the study period, and 16/20 (80%) responded to surveys or phone calls at an average of 10.0 ± 3.5 years post procedure. Four sports medicine physicians with advanced ultrasound training/experience performed the procedures. Baseline VAS-Pain was 7.5 ± 1.9 . At final follow-up, VAS-Pain with first 5 steps was 0.5 ± 0.9 , VAS-Pain with weight-bearing through the day was 0.6 ± 1.4 , and global assessment of function was 8.4 ± 2.8 . Overall, 14 of 16 patients (88%) were “very satisfied” with the procedure, and 100% would recommend it to others. Two of 16 (12.5%) underwent a subsequent procedure (each a corticosteroid injection). The mean administered PRP volume was 2.6 ± 0.7 mL. The PRP used was erythrocyte/neutrophil-depleted. In cases where PRP composition was analyzed, mean platelet dose was 6.2 ± 1.7 billion. No complications were reported during study review.

Conclusions: PRP-NF using an erythrocyte/neutrophil-poor product provides long-term pain relief and high satisfaction for most patients with chronic plantar fasciopathy. Complications from PRP-NF are uncommon when performed by physicians with advanced ultrasound training/experience.

Significance: PRP-NF is a safe, effective, and durable treatment option for chronic plantar fasciopathy. To our knowledge, this is the longest-term study to date of outcomes using PRP-NF in the management of plantar fasciopathy.

Acknowledgments: We would like to thank the patients of Mayo Clinic for their willingness to participate in our study.

TOPIC: Education

STUDY: Survey

Evaluating and Increasing High School Athlete's Understanding of How Recovery Improves Performance

Primary Author/Presenter: Gianpaolo Rufo, DO

John Williams, MD

Affiliation: Middlesex Health, Middletown, Connecticut.

Purpose: (1) To evaluate the understanding that High School athletes have of how 5 topics of recovery impacts their athletic performance. (2) To investigate if educating the student athletes about the 5 topics of recovery via a one time information session made a difference in their understanding.

Methods: Nineteen student athletes (19 males, age 15-18, all private school students) were given a Likert scale before and after the intervention. The intervention was a single 45-minute information session that educated the students about the 5 topics. The Likert scale (based on 1-5) assessed student athletes' knowledge on how the 5 aspects of recovery impacted their athletic performance.

Results: Five different topics were evaluated which includes nutrition, sleep, hydration, active recovery, and mental wellness. A 2-tailed *t*-test was calculated to determine the mean Likert scale score for each of the 5 topics. There was an increase in knowledge reported by the student athlete in all 5

of the topics. All of the 5 topics showed significantly higher levels of knowledge ($P < 0.05$). The most significant result was active recovery through ACL prevention exercises ($P < 0.00000007$). These results demonstrate that as a collective group, the students all showed an increase in knowledge after the information session.

Conclusions: These results demonstrate that as a collective group, the students all showed an increase in knowledge after the information session. To the best of our knowledge, this is the first report of an effective method to educate High School athletes on how 5 topics of recovery contribute to and can increase athletic performance.

Significance: By educating high school athletes there is potential to have long lasting effects and reduce rates of bone stress injury as they advance through their athletic careers

Acknowledgments: Thank you to Dan Deconti and Xavier High School Athletic Department.

TOPIC: Epidemiology

STUDY: Survey

Supplement Use in High School Athletes: The Where and the Why

Primary Author/Presenter: Gianpaolo Rufo, DO

James Smith, MD, MPH, Matthew Hall, DO, and Alison Schafer, DO

Affiliation: University of Connecticut Primary Care Sports Medicine.

Purpose: To explore the use of supplements in high school athletes, with the goal to learn about why the athletes are taking them and where they are getting their information and looking at the information distributed on social media.

Methods: The target was high school students enrolled in sports at one of the Hartford Public Schools. Participation letters were distributed to the parent portal the schools used. An anonymous survey was created using Qualtrics which was accessed using QR codes. As an incentive for students to fill out the survey, at the end the students were given the opportunity enter a drawing for \$50 to amazon.

Results: Twenty-seven surveys were completed across the schools. There was close to even split between males and females. Most of the participants have been involved in their sport for 2 to 3 years. Sixteen reported having used supplements in the past and of those, 9 said they had used in the past year while 4 reported maybe. When asked where students heard about supplements from, the most common answer was social media and following that was friends. Tik tok and Instagram were the most reported platforms. Improved performance was the most common reason for taking supplements while some other popular responses were muscle, energy and weight loss. There was no one source of protein that was significantly more popular than the others. For those that had taken supplements, 8 reported they talked to no one and then 4 reported talking to friends and 4 talked to their family. Only 2 talked to dietician or doctor. Personal trainers were the most common persons to be providing the information on these platforms.

Conclusions: Most of the information that the students obtain their information was from social media. Very few athletes receive their information from a RD or a physician. It seems the most common reason that the high school students use the supplements is to improve their performance, not to supplement their diet.

Significance: By understanding where the athletes are getting their information and how it is distributed, it can allow the medical community to better educate student athletes to reduce potential harms that the supplements carry.

Acknowledgments: Thank you to the Hartford Public Schools.

TOPIC: Education

STUDY: Survey

Preparedness of Incoming Sports Medicine Fellows: Implications for Training Amongst the Specialties

Primary Author/Presenter: Javier Santana, MD

Scott Klass, MD, Martin Weaver, MD, Edward Tiozzo, PhD, and Timothy Tiu, MD

Affiliation: Christine E. Lynn Rehabilitation Center, Miami, Florida.

Purpose: To identify if there are differences in the proficiency of incoming primary care sports medicine (PCSM) fellows based on primary training: emergency medicine (EM), family medicine (FM), internal medicine (IM), pediatrics (PED), or physical medicine and rehabilitation (PM&R).

Methods: We created a survey asking each program director (PD) to evaluate the proficiency of their fellow(s) in domains based on Accreditation Council of Graduate Medical Education (ACGME) milestones. We also asked for the expected level of proficiency of the incoming fellow in each domain. The survey was sent individually to each PD via institutional email after the fourth month of the academic year.

Results: Analysis revealed 9 domains with significant differences between fellows. FM and EM were more proficient than PM&R in performing non-musculoskeletal (MSK) examinations. Conversely, PM&R was more proficient than FM, IM, and PED in performing MSK examinations. FM, EM, and PED were more adept than PM&R in managing the non-MSK conditions in sports medicine, which confirmed PD expectations. EM was more proficient than PM&R, FM, and IM in managing emergent injuries and conditions at sporting events. PM&R was more proficient than FM in the basic theoretic principles of ultrasound (US). Similarly, PM&R was more proficient than PED, FM, EM in the basic practical principles of US. PDs expected higher proficiency with MSK MRI interpretation for PM&R versus FM. PM&R has a more genuine interest in academic projects compared to FM. Finally, FM was more knowledgeable in billing and coding than PM&R and EM. However, overall, there were no differences among fellows regardless of primary specialty.

Conclusions: Our study demonstrates that while there are overall no differences in preparedness for PCSM fellowship among fellows of various specialties, there are areas with statistically significant differences in both fellows' capabilities based on primary specialty training, and the PDs' expectations of trainees. Our study results highlight the specific strengths and weaknesses as identified by ACGME PCSM fellowship program director survey-respondents.

Significance: PCSM graduates can be expected to fulfill all related responsibilities regardless of primary specialty. Residency and fellowship programs may target specific domains to enhance the professional development of future sports medicine physicians.

TOPIC: Other

STUDY: Survey

What SUP With Yoga on the Water

Primary Author/Presenter: Eric Schmidt, MD

Yone-Kawe Lin, MS and Andrew Nichols, MD

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

Purpose: The aim of this study is to obtain baseline stand-up paddleboard (SUP) yoga participants' demographics, behaviors, and perceived benefits of the activity, as well as to increase awareness of SUP yoga in the academic sports medicine community.

Methods: A 19-item paper survey instrument was voluntarily administered with consent to attendees and instructors (age > 17 years) of 2 separate Honolulu-based SUP yoga companies following the completion of several classes between August 26 to October 30, 2022. The data was statistically analyzed using software to report response frequencies, percentages, and associations using the Fisher's exact test.

Results: All 31 SUP yoga invited class participants completed the survey (100% response rate), with 90% being female and 68% between ages of 18 and 40 years. Subjects' stated residences are Hawai'i (68%), the continental USA (23%), and international (10%). This was 71% of respondents' first SUP yoga class, and all plan to participate in SUP yoga again. We found that 29% practice land-based yoga more than once per month while 26% had never practiced land-based yoga. Additionally, 29% had never been on a SUP before and 70% stated that being "fun" is their primary motivation for participating. When compared to land-based yoga, improvement in balance was the most often (87%) perceived benefit of SUP yoga, followed by mindfulness (58%), muscle strength (55%), stress management (52%), and flexibility (48%). No SUP yoga-related injuries were reported. No significant associations were identified between Hawai'i residents versus visitors or first-time versus multiple-time participants.

Conclusions: SUP yoga practitioners are predominantly female and often first-time enthusiasts who plan to return to the activity. Further, SUP yoga is widely considered to be fun and has specific perceived health benefits when compared to land-based yoga. Although no injuries are reported by our study participants, further investigations are required to elucidate any definite health benefits and risks of SUP yoga.

Significance: SUP yoga provides an alternative option to land-based yoga with balance and mindfulness representing 2 proposed advantages. Sports medicine practitioners should be aware of this new form of yoga with its unique potential benefits and risks.

Acknowledgments: Chathura Siriwardhana, PhD. Yoga Floats Island Paddle Bliss.

TOPIC: Ultrasound

STUDY: Other

Comparison of Comfort and Patient Preference of Common and a Novel Ultrasound-Guided Carpal Tunnel I

Primary Author/Presenter: Kersten Schwanz, MD

David Balser, MD, Alexander Senk, MD, Margaret Crosby, Willis Schuerger, Luke Walters, MD, and Corey Wheelock, MD

Affiliation: Department of Rehabilitation Medicine, University of Minnesota, Minnesota.

Purpose: Ultrasound-guided carpal tunnel injections require patients to hold positions exposing the volar wrist, which can cause discomfort. Intra-procedure position adjustment increases the risk of structure injury and prolongs the intervention. This study aimed to compare discomfort among 3 positions.

Methods: A cohort of 30 ambulatory Veterans referred for EMG evaluation of carpal tunnel syndrome were asked to hold 3 different positions: (1) hypersupination, (2) airplane, and (3) TSA (novel position). Participants rated their pain level, ease of performing/holding each position, exacerbation of underlying symptoms, and position preference. Results were analyzed with a 2-way repeated measures ANOVA.

Results: The hypersupination position was the least preferred and most painful position for subjects to hold. This was demonstrated with a statistically significant increase in the Numeric Rating Scale score for pain while holding the position when compared to the airplane and TSA positions. The airplane and TSA positions were not significantly different from one another. Pre-procedural neck, shoulder, elbow, and wrist pain were not significantly associated with intra-procedural pain. However, participants with lower Patient-Rated Wrist Evaluation scores were statistically less likely to hold any position.

Conclusions: Of the 3 positions investigated, hypersupination is the least tolerated for patients with carpal tunnel syndrome. Airplane or TSA positions are similarly tolerated and are associated with lower levels of discomfort for patients. Clinical space, resources, patient mobility, and laterality of procedures may further guide one's selection amongst the positions.

Significance: For ultrasound guided carpal tunnel injections, patient comfort can be optimized by avoiding hypersupination. Airplane or TSA positions may provide similar access for ulnar approach injections while inducing lower levels of discomfort for patients.

TOPIC: Other

STUDY: Other

The Pointe Assessment Screen Shah Edison (PASSE) Validation Study

Primary Author/Presenter: Selina Shah, MD, FAMSSM, FACP

Dana Sheng, MD, Bianca Edison, MD, Tishya Wren, PhD, and Tracy Zaslow, MD

Affiliation: BASS Medical Group, Walnut Creek, California.

Purpose: Despite the demands of dancing on pointe, no standard exists to determine when a dancer is ready to advance to this next level. The goal of this study is to validate a screening tool (PASSE) that will determine (1) if a dancer is ready for pointe and (2) areas for improvement.

Methods: Seventeen dancers from 2 studios were prospectively evaluated by 2 physicians each using a tool that combined Shah and Edison's readiness for pointe screens. Evaluators were blinded to dancers' history and the studios' judgement of their readiness. Descriptive statistics, kappa, and logistic regression were used to assess interrater reliability and the relationship of individual tests to pointe readiness.

Results: There was excellent agreement among raters in determining overall pointe readiness (94%, $P = 0.0004$).

There was fair agreement for grand plie (73%, $P = 0.04$); moderate to substantial for saute (76%, $P = 0.002$), topple test (76%, $P = 0.002$), airplane test (85%, $P = 86\%$) for all tests, suggesting that failure on any test could indicate overall lack of readiness for pointe. Each test had subcomponents (i.e., quiver, break, stable landings, balance) that affected the overall pass for that test with interrater reliability of 53% to 100%.

Conclusions: This study validates the PASSE screen to determine pointe readiness with excellent interrater agreement for the overall pass/fail rate and significant agreement for tests that contribute to readiness. At minimum, dancers must be able to pass the grand plie, ankle plantar flexion, and releve tests. Passing the saute, releve passe, and airplane tests indicates high likelihood of readiness. A larger sample size may help to confirm these results.

Significance: This is the first screening tool to be validated to determine readiness for pointe. Such a tool provides a standard in order to protect the wellbeing of the student and potentially reduce the risk of sustaining injuries throughout dancers' training.

Acknowledgments: Jacquelyn Valenzuela-Moss.

TOPIC: COVID-19

STUDY: Survey

Effect of COVID-19 on Mental Health in NCAA Division I Athletes

Primary Author/Presenter: Vikas Shahi, MD

Robert Kiningham, MD

Affiliation: University of Michigan, Ann Arbor, Michigan.

Purpose: The COVID-19 pandemic had a significant impact on the lives of collegiate athletes. To that end, we seek to study the mental health impact of the COVID-19 pandemic on National Collegiate Athletic Association division I student-athletes with respect to return to play after the nationwide lockdown.

Methods: We conducted a longitudinal survey study at a NCAA division I University. At their pre-participation physical in Summer 2020, participants answered questions assessing anxiety and/or difficulty sleeping because of returning to play during the COVID-19 pandemic. PHQ-9 data was obtained. In Summer 2021, participants filled out a questionnaire assessing pandemic literacy.

Results: Four hundred twenty-eight athletes completed the survey in Summer 2020. 70/428 (16.4%) athletes screened positive as to having answered "yes" to either being anxious and/or having difficulty sleeping with respect to return to play due to COVID-19. Football had the most male athletes screen positive, 24/116 (20.7%). Women's Rowing had the most female athletes screen positive, 15/59 (25.4%). 34/210 (16.2%) athletes screened positive in men sports, compared to 36/218 (16.5%) athletes in women sports. There was no significant difference between PHQ-9 scores and responses to the Summer 2020 survey. 33 individuals screened positive on PHQ-9 (score greater than or equal to 5). Summer 2021 questionnaire aided in assessing athletes' experience with the pandemic, vaccine, and University policies and was not included in statistical analysis. The Summer 2021 questionnaire aided in developing an anonymous hotline where athletes could report colleagues breaking quarantine and/or COVID-19 regulations at the University.

Conclusions: Our results indicate that COVID-19 led to self-reported anxiety and difficulty sleeping with respect to return to play after the lockdown amongst some of our Student-Athletes but not necessarily depression, due to no statistical significance when comparing self-reported answers with PHQ-9 scores. Additionally, there was no gender difference for these pandemic-related concerns.

Significance: The COVID-19 pandemic itself was a source of anxiety and sleep disturbance in many athletes who participated in our study. Hence, mental health and COVID-19-related resources should be available to Student-Athletes across the nation.

TOPIC: Concussion

STUDY: Cohort

Depression and Anxiety Screening Following Concussion

Primary Author/Presenter: Alan Shahtaji, DO

Edward Hodgkin, MD and Doug Chang, MD

Affiliation: UC San Diego Health, San Diego, California.

Purpose: Compare depression and anxiety affective symptoms from the Sports Concussion Assessment Tool-5th Edition (SCAT-5), to the Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder 7-item (GAD-7) questionnaires.

Methods: Retrospective analysis of adult patients who presented to sports concussion clinic after having sustained concussion. Inclusion criteria is >18 years old. Symptom severity was determined using a modified SCAT-5 (internally known as Acute Concussion Evaluation (ACE)) and comparing the “nervous or anxious” and “sadness” symptom scores to the GAD-7 and PHQ-9 total scores, respectively for concordance.

Results: The results indicate a significant, large positive correlation between the SCAT-5 sadness score and PHQ-9, [$r(16) = 0.70, P = 0.007$]. Conversely, there was a small, non-significant positive correlation between the SCAT-5 nervous, anxiety score and GAD-7, [$r(16) = 0.21, P = 0.0394$].

Conclusions: This study suggest that anxiety symptoms following sports concussion may be difficult to measure. It's unclear whether more subjects are needed to confirm a relationship between the SCAT-5 and GAD-7, whether the SCAT-5 could be modified to better incorporate anxiety symptomatology, or whether anxiety as a condition simply presents more variably compared to depression.

Significance: This research demonstrates the reliability of using the SCAT-5 for anxiety and depression screening. Additional research is needed to solidify this finding and whether to consider additional mental health screening questions to the SCAT-5.

Acknowledgments: Lisa Black, PsyD Victoria Merritt, PhD Elizabeth Claypool, ATC.

TOPIC: COVID

STUDY: Cohort

Concussion Incidence After COVID-19 Infection

Primary Author/Presenter: Brian Smerkers, MD

Calan Sowa, MD, MA and Vicki Nelson, MD, PhD

Affiliation: Prisma Health.

Purpose: Since the start the COVID-19 pandemic, there has been significant interest in the longterm effects of COVID-19

infection. How infection may predispose to the development of concussions is unknown. In this study we sought to investigate the association of COVID-19 and subsequent concussion.

Methods: A database of all reported injuries and illnesses of athletes, both high school and collegiate, under the Prisma Health ATC network during the 2020 to 2021 calendar years was analyzed. A χ^2 analysis comparing the baseline concussion rate in those who did not have reported COVID-19 to a separate group who had reported COVID-19 and developed subsequent concussion was calculated.

Results: A total of 4619 athlete injuries or illnesses (44.6% male, 55.4% female; 71% high school, 29% collegiate) were reported to the Prisma Health ATC injury and illness database during the 2020 to 2021 calendar years. Of these, there were 528 reported cases of COVID-19 infection, with 34 of these cases subsequently developing a concussion, leading to a concussion rate of 6.4%. Based on prior studies in this population, during the same time frame, there was a baseline rate of concussion of 3% in athletes without reported COVID-19 infection. Comparing our baseline concussion rate of 3% to our COVID-19 concussion rate of 6.4% via a χ^2 analysis revealed a significant difference with a value of 6.80 ($P < 0.01$). While not powered to analyze the time periods after infection it is noteworthy that 61.5% of the concussions occurred within 2 months of infection.

Conclusions: There has been significant interest in the longterm effects of COVID-19 infections. Prior investigations have shown lasting symptoms in 53% of patients months after primary resolution. In this investigation we have shown that there is a significant increased risk of concussion after COVID-19 infection. It is noteworthy, although significance is uncertain, that 61.5% of the concussions occurred within 2 months of infection.

Significance: This study shows a risk between COVID-19 infection, and subsequent development of concussion. It is not currently clear the underlying mechanism that may predispose athletes to subsequently develop concussions and should be further investigated.

Acknowledgments: Steadman Hawkins Sports Medicine Network.

TOPIC: Education

STUDY: Other

Description of Confidence Level and Knowledge Changes After Sports Coverage Training for PM&R Residents

Primary Author/Presenter: Derek Stokes, MD

Marc Heronemus, MD, Jeri Forster, PhD, Scott Laker, MD, and Adele Meron, MD

Affiliation: Department of Physical Medicine and Rehabilitation, University of Colorado, Aurora, Colorado.

Purpose: Residents interested in sports medicine are recommended to participate in sports coverage. The AMSSM PM&R Curriculum Subcommittee provided guidance on sports coverage topics to include in resident education. This pilot describes changes in knowledge and confidence after sports coverage education.

Methods: PM&R residents from a single residency program were invited to participate in a pre-season sports coverage workshop prior to the fall sports season. The formalized sports coverage education was assessed via survey

and written exam collecting subjective confidence ratings and objective knowledge scores of sports coverage topics pre-workshop, post-workshop, and post-season.

Results: Six residents participated in the pre-season workshop and completed each assessment. No participating residents had prior sports coverage training. Five of 6 residents participated in fall sports coverage. Overall, median post-workshop confidence ratings were improved and maintained above pre-workshop ratings at post-season (pre-workshop, post-workshop, post-season) (3.00, 4.00, 4.00). Post-workshop median confidence ratings were increased in 6 of 6 residents and 8 of 8 sports coverage topics with both maintained above pre-workshop ratings at post-season, respectively. Total post-workshop written exam scores were improved and maintained above pre-workshop scores at post-season (64.3%, 73.8%, 66.7%). Post-workshop scores were improved in 5 of 6 residents with 3 of 6 maintained above and 1 of 6 equal to pre-workshop scores at post-season, respectively. Post-workshop median knowledge scores were improved in 4 of 7 topics and maintained above the pre-workshop scores at post-season.

Conclusions: Post-workshop confidence ratings were improved globally and maintained above pre-workshop values at post-season. Post-workshop objective knowledge scores revealed improvements collectively and individually compared to pre-workshop values at post-season. However, more variability existed with objective knowledge scores in addition to some discrepancies between subjective confidence ratings and objective knowledge scores.

Significance: This pilot study provides data supporting that formalized sports coverage education may improve physical medicine and rehabilitation residents' confidence and objective knowledge. Resident education may benefit from including such training.

Acknowledgments: University of Colorado Department of Physical Medicine and Rehabilitation, collaborating attending physicians including Scott Laker, MD and Adele Meron, MD, and all participating residents.

TOPIC: NCAA

STUDY: Survey

Menstrual Health Awareness and Misconception in Collegiate Athletes: A Pilot Study

Primary Author/Presenter: Samantha Stueck, MD

Matthew Hall, DO, Allison Schafer, DO, and Julie Burland, PhD, ATC, CSCS

Affiliation: University of Connecticut, Hartford, Connecticut.

Purpose: To evaluate the incidence of which medical specialties are prescribing oral contraceptive pills (OCPs) for irregular menstrual cycles representing oligomenorrhea/amenorrhea and to evaluate athletes' misconceptions that it is normal to have irregular menses as an athlete.

Methods: Female athletes completed a survey during annual pre-participation examinations (PPEs). PPEs were conducted by the team physicians and Athletic Trainers. During the PPE, athletes were familiarized with the study and scanned a QR code or accessed the approved survey via hyperlink. Athletes were included if they were ≥ 18 , read an information sheet describing the study and completed the survey.

Results: Eighty-six collegiate female athletes completed the survey (34.9% freshman, 18.6% sophomore, 11.6% junior,

22.1% senior, 8.1% graduate students). 7% were characterized as primary amenorrhea having the onset of menses after age 15. 16 (18.6%) athletes screened positive for menstrual irregularity that were taking oral contraceptives for irregular menstrual cycles. 11.6% and 6.9% presented with oligomenorrhea and amenorrhea, respectively. 65% of athletes responded that they were told it was normal to have irregular menses as an athlete. 30 freshman athletes responded; 56% were told it was normal to have irregular menses as an athlete. Of those that screened positive for menstrual irregularity 25% stated OCPs were prescribed by their OBGYN, 4% by a pediatrician and 68% did not designate a specialty. 34.8% of all athletes and 33.3% of freshmen feel that missing a period is normal and expected. 3.4% of all athletes and 6% of freshmen saw it as a success in training.

Conclusions: These data highlight that there is a subset of female athletes with menstrual irregularities who take oral contraceptives. OCPs can mask the symptoms of menstrual irregularity which is a component of relative energy deficiency in sport and can increase the risk of undiagnosed bone stress injuries. Additionally, there are misconceptions regarding menstrual cycles in both athletes and in the physicians that provide them care.

Significance: These data demonstrate low athlete and physician awareness regarding menstrual health and symptoms of relative energy deficiency. Addressing this educational barrier may help improve menstrual health perceptions and decrease the incidence of RED-S.

Acknowledgments: I would like to thank the athletic trainers at the University of Connecticut who helped carry out this survey with the athletes. I would also like to thank Dr. Deena Casiero who helped with the approval of this research at the university level.

TOPIC: Epidemiology

STUDY: Other

Epidemiology of Golf-Related Injuries: A 10-Year Analysis of the NEISS Database and the Impact of Alcohol Consumption

Primary Author/Presenter: Jeremy Swisher, MD

Zachary Sitton, MD and Chris Miles, MD

Affiliation: Wake Forest University School of Medicine, Winston-Salem, North Carolina.

Purpose: Golfing has increased in popularity tremendously over the past 10 years. As the population of athletes grows, so should the body of research to understand the prevalence and types of injuries that are common within the sport, as well as the impact of alcohol consumption on these golf injuries.

Methods: Data on 11078 golf-related injuries within the National Electronic Injury Surveillance System (NEISS) were analyzed over a 10-year period. Pivot tables were created to examine trends. Incidence rate ratios and confidence intervals were obtained, and χ^2 tests were used to determine significance. Three hundred seventy-one injuries were removed from the study due to not being directly sustained while golfing.

Results: The mean age was 46 years old. Males ($n = 7605$, 71.03%) accounted for more injuries than females. The most common injuries were Sprain ($n = 1699$, 15.87%), Laceration ($n = 1544$, 14.42%), and Fracture ($n = 1340$, 12.52%). The most common locations of injuries were the Head ($n = 1866$, 17.43%), Lower Trunk ($n = 1227$, 11.46%), and Upper

Trunk ($n = 1190$, 11.11%). The most common lower extremity injury location was the Knee ($n = 610$, 5.70%). The most common upper extremity injury location was the Shoulder ($n = 447$, 4.17%). When injured while consuming alcohol, the rate at which the injury was a fracture increased from 12.39% to 18.11% (IRR 1.46 [95% CI, 1.05-1.97]; $P = 0.018$), syncope increased from 2.63% to 9.47% (IRR 3.51 [95% CI, 2.19-5.38]; $P = 0.0001$), and internal injury increased from 9.48% to 23.05% (IRR 2.43 [95% CI, 1.82-3.18]; $P = 0.0001$). The injury location most common with alcohol consumption was the head, which increased from 16.95% to 37.86% (IRR 2.23 [95% CI, 1.79-2.75]; $P = 0.0001$).

Conclusions: The most common injuries in golf include sprains, lacerations, and fractures. When alcohol is involved, the severity of injuries increases, with fracture and internal injury becoming the most prevalent, as well as a significant increase in head injuries and syncope. Alcohol is a known risk factor for injury, and this data further elucidates that when combined with golf, alcohol significantly increases your risk for more severe injuries.

Significance: This research helps better characterize the most common injury patterns in the sport of golf. Increased awareness of the severity of injuries that can occur in golf when alcohol is consumed can be used to educate golfers on the risks involved.

Acknowledgments: Thank you to Dr Chris Miles for his guidance and Stephen Davis for his help with the statistics!

TOPIC: Education

STUDY: Survey

Evaluation of Exercise Prescription Preparticipation Screening Knowledge in a Family Medicine Residency

Primary Author/Presenter: Rehan Talibi, DO

Brian Kim, MD, MS

Affiliation: University of California, Irvine Sports Medicine Fellowship, Irvine, California.

Purpose: To evaluate Family Medicine Resident and Faculty knowledge of exercise prescription counseling and preparticipation health screening using the American College of Sports Medicine (ACSM) guidelines published in 2015.

Methods: Residents and Faculty were surveyed and tested before and after a lecture on Exercise Preparticipation Screening. The pre and posttest consisted of the same 10 clinical vignettes. The survey included topics querying prescribing, training in, and awareness of ACSM guidelines on preparticipation screening (2015). Two-sample t -test calculations analyzed mean differences of pre and posttest scores.

Results: There was a total of 21 participants. 61% of participants had no prior education on exercise prescription counseling or screening for medical clearance. 80% of participants had not written an exercise prescription in the past year. Ninety percent of participants reported being unaware of the ACSM guidelines. There was a significant improvement in overall scores pre to posttest: 66% to 79% ($P < 0.05$). Pre versus posttest improvements were seen in all levels of training: interns: 60% to 83%; Senior residents: 70.5% to 80%; Faculty: 63% to 73%.

Conclusions: A majority of Family Medicine Residents and Faculty have never had training in exercise medicine, written

an exercise prescription in the past year and were unaware of the current ACSM guidelines on this topic. Baseline knowledge of exercise prescription counseling was found to be deficient. Following a structured educational activity increases knowledge, exercise prescriptions counseling, and risk stratifying.

Significance: These findings show that formal education in Family Medicine Residency may enhance knowledge base to allow proper exercise medicine preparticipation screening and counseling.

TOPIC: Running

STUDY: Cohort

Low Energy Availability Prevalence in Male and Female Collegiate Distance Runners: A Multisite Analysis

Primary Author/Presenter: Altelisha Taylor, MD

Michael Fredericson, MD, Michelle Barrack, PhD, Kristin Sainani, PhD, Ellie Diamond, BS, Megan Roche, MD, Taylor Lewis, BS, Aurelia Nattiv, MD, Emily Kraus, MD, and Jenny Wang, BS

Affiliation: University of California Los Angeles (UCLA), Los Angeles, California.

Purpose: Many distance runners don't consume enough calories to meet their metabolic demands. Low energy intake can cause nutritional deficiencies, hormone imbalances, and poor bone health. This is one of the only studies to examine the prevalence of low energy availability in collegiate distance runners.

Methods: Data were from the baseline measurement of a study on distance runners from 5 NCAA division I institutions in the Pac-12. We calculated energy availability from a web-based 61-item survey evaluating runners' age, height, weight, exercise habits, and food intake over the prior 4 weeks. Exercise energy expenditure was based on metabolic equivalents from the ACSM Compendium of Physical Activity.

Results: Female cross-country athletes ($n = 59$), mean age 20.2 (SD 1.8) years with a mean BMI of 20.4 (SD: 2.3) kg/m² and male cross-country athletes ($n = 11$) age 20.9 (SD: 2.4) years with a BMI 20.5 (SD: 1.9) kg/m² reported running 42.3 (SD: 14.9) and 74.8 (SD: 8.3) miles weekly. Females consumed an average of 2739 (SD: 784) kcal/d and males reported an average intake of 3,201 (1160) kcal/d. Eight (13.6%) female runners met criteria for clinical low energy availability (< 30 kcal/kgFFM/d) and 19 (32.2%) met criteria for subclinical low energy availability (30-45 kcal/kgFFM/d). In men, 2 (18.2%) exhibited clinical low energy availability (< 15 kcal/kgFFM/d) and 4 (36.4%) met criteria for subclinical low energy availability (15 kcal/kgFFM/d to 30 kcal/kgFFM/d).

Conclusions: The rate of low energy availability is high among the female and male collegiate distance runners in this study. Overall, 46% (27/59) of women and 55% (6/11) of men had clinical or subclinical low energy availability, suggesting that many collegiate distance runners are not consuming enough calories to meet the metabolic demands of their sport.

Significance: Nearly half of female and male distance runners have low energy availability, increasing their risk for nutritional deficiencies and bone stress injuries. This study underscores the need for nutritional interventions in collegiate distance runners.

Acknowledgments: The authors would like to thank the Pac-12 Student Athlete Health and Well-Being Grant for funding this study.

TOPIC: Concussion

STUDY: Cohort

Evaluating the Role of QEEG Evoked Potential Voltage Patterns in Predicting MRI Abnormalities in Pediatric Concussion Patient

Primary Author/Presenter: Prem Thirunagari, BS, BSHS

Hector Preciado, DO, Saikaashyap Sarva, MBS, Brett Dusenberry, MD, Leslie Streeter, DNP, Dave Oakley, PhD, and Mo Mortazavi, MD

Affiliation: University of Arizona College of Medicine, Tucson, Arizona.

Purpose: Decision-making in whether or not and when to order brain imaging for traumatic brain injuries (TBI) is challenging and not well established in the literature. Our study's purpose is to identify trends between evoked potential voltages and MRI imaging abnormalities for complex concussion management.

Methods: A retrospective cohort study of 68 pediatric patients with prior concussion (at private concussion clinic), qEEG results (tested with P300 EEG protocol), and MRI readings (by private radiology group) from September 26, 2019 to May 26, 2021. Patients were stratified using 2 criteria (criteria 1—trauma-related MRI abnormalities, criteria 2—any type of MRI abnormality, including incidental findings).

Results: Based on stratification by criteria 1, there was a trend with the MRI concussion positive group ($n = 14$, trauma related MRI findings including white matter tract abnormalities, nonspecific gliosis, and diffuse axonal injury) having a lower mean qEEG voltage (9.1) compared with the MRI concussion negative ($n = 44$ patients, included no MRI imaging findings and non-concussion related imaging abnormalities) group's mean qEEG voltage (9.6). Analysis of the second criteria classification demonstrated a trend with the MRI overall positive group ($n = 34$, included concussion patients with any type of MRI abnormality, including incidental findings) having a lower mean qEEG voltage (9.3) compared with the MRI overall negative ($n = 24$, included patients with a normal MRI) group (9.6). Statistical analysis using t -tests assuming equal variances demonstrated non-statistically significant results in both methods of stratification, with P -values of 0.81 and 0.87 respectively at an alpha = 0.05.

Conclusions: A potential trend exists between reduced P300 voltage in patients with MRI abnormalities compared with normal MRI subsets. More studies and increased sample sizes are required to further evaluate the trend and determine whether qEEG voltages can be used as a predictor for concussion severity (based on MRI findings), prognosis, and management.

Significance: Recent studies suggest that up to 40% of mTBIs with PPCS endorse trauma related findings on MRI. Exploring the utility of qEEG in predicting MRI abnormalities could serve as a critical marker for advanced neuroimaging in complex concussion cases.

Acknowledgments: We would like to thank and acknowledge everyone on the SPARCC team for their contribution.

TOPIC: Concussion

STUDY: Cohort

Utilization of a Validated Concussion Profile Screen to Assess Homologous Functional Neurologic Deficits

Primary Author/Presenter: Prem Thirunagari, BS, BSHS

Daniella Rivera, MS, Leslie Streeter, DNP, Leila Samsam, DNP, Sarah Lawson, DO, Taylor Seitz, and Mo Mortazavi, MD

Affiliation: Sports Medicine, Rehabilitation and Concussion Care (SPARCC), Tucson, Arizona.

Purpose: To assess utility of the validated Concussion Clinical Profiles screening tool (CP screen) (1) and specific symptom profiles as an assessment tool for long COVID patients with neurological sequelae.

Methods: Retrospective review of 16 long COVID patients (4 male, 12 female), ages 13 to 66 (avg 46), with average of 10 months from COVID infection at CP screen assessment. Seven concussion profile symptom scores were assessed with the CP screen.

Results: The top 3 CP profile symptoms scores were cognitive (cog) fatigue, mood, and sleep. The 7 profiles showed a total CP score average (avg) of 34/89 (range 7-68), cognitive fatigue avg of 1.8/3 (range 0-3), mood avg of 1.5/3 (range 0-2.8), sleep avg of 1.4/3 (range 0.5-3), visual avg of 0.9/3 (range 0-2.6), cervical avg of 0.9/3 (range 0-2.5) vestibular avg of 0.8/3 (range 0-2.2), and migraine/headache score avg of 0.8/3 (range 0-2). The cog fatigue score was the highest profile score in 8/16 patients, who endorsed it as the predominant complaint. Furthermore, 2/16 endorsed cog fatigue tied as the main profile with sleep and 1/16 had cog fatigue tied with mood. Only 1/16 had cervical as the predominant profile. The lowest scoring profiles were migraine/headache, vestibular, and visual profiles, with 3/16 patients reporting no vestibular, and 3/16 reporting no visual complaints on the screen.

Conclusions: COVID long haulers report symptoms of cognitive impairment often described as brain fog or cognitive fatigue. The CP screen findings in long COVID patients are similar to symptom profiles in patients with persistent post-concussive syndrome (PPCS), with cognitive fatigue most often reported as predominant.

Significance: As with PPCS, the CP screen may be a useful tool to identify overall symptom burden and predominate profiles in patients with Long Covid functional neurological deficits. The CP screen facilitates comprehensive assessments and targeted treatments.

Acknowledgments: We would like to thank and acknowledge everyone on the SPARCC team for their contribution.

TOPIC: Concussion

STUDY: Cohort

Presenting Force Plate Sway Velocity as an Objective Predictor of Prolonged MTBI/Concussion Recoveries

Primary Author/Presenter: David Tramutolo, DO

Brett Dusenberry, MD, Claire Finkel, MD, Leslie Streeter, DNP, Leila Samsam, DNP, Jon Minor, MD, and Mo Mortazavi, MD

Affiliation: University of Missouri, Columbia, Missouri.

Purpose: Up to 30% of patients with mild traumatic brain injury (mTBI) may develop prolonged post-concussion symptoms (PPCS). The purpose of this study is to evaluate the utility of objective force plate sway velocities as a

predictive tool for those who may have more prolonged recoveries after mTBI.

Methods: This is a retrospective cohort study of 35 mTBI patients. Patients were dichotomized based on PPCS duration (subacute, <3 months, $n = 13$, group 1; chronic, >3 months, $n = 22$, group 2). Force plate data measuring sway deviation/s was gathered within 1 month of concussion onset using 2 feet stances with eyes open and eyes closed and repeated on a foam pad. Groups were compared using a t -test.

Results: Sway deviation had a mean of 0.36 deg/s in group 1 and 0.54 deg/s in group 2 ($P = 0.046$) in the eyes open (EO) condition. Similarly, in eyes closed (EC) condition, group 1 (0.58 deg/s) had lower sway deviation than group 2 (0.82 deg/s, $P = 0.049$). The sway deviations on the medium density foam pad were similar between groups in EO condition (0.66 deg/s in group 1 vs 0.82 deg/s in group 2, $P = 0.17$), but different in the EC condition (1.4 deg/s in group 1 vs 1.76 deg/s in group 2, $P = 0.042$). Overall, comprehensive sway deviations were noted to be worsened in group 2 (0.75 deg/s in group 1 vs 0.97 deg/s in group 2, $P = 0.04$).

Conclusions: Increased presenting sway deviations with EO, EC, foam EC and comprehensive conditions in chronic compared to subacute recoveries support the use of force plate sway velocity as a modality that can aid in concussion diagnosis, subtyping, and prognosis. To our knowledge, this is the first study to show predictive value of sway velocity for chronic symptoms >3 months after concussion.

Significance: Subtle postural force plate sway deviations appear to offer predictive value for individuals at risk for PPCS. Validation of such an objective tool for prognostic purposes would be a significant advancement in the care of mTBI patients.

TOPIC: Concussion

STUDY: Other

Concussion Characteristics and Time to Medical Clearance Among Youth Adventure Sport Athletes

Primary Author/Presenter: Daniel Truong, DO

Mathew Wingerson, MS, Corrine Seehusen, BS, Katherine Smulligan, PT, DPT, Samantha Magliato, BS, Aaron Provance, MD, Julie Wilson, MD, and David Howell, PhD, ATC
Affiliation: University of Colorado, Denver, Colorado.

Purpose: To compare concussion characteristics and time from symptom resolution until clearance for return to play those injured during adventure sports (skiing, martial arts, motor cross, snowboarding, or skateboarding), non-sport mechanisms, and traditional sport (soccer).

Methods: This was a retrospective chart review of patients 6 to 18 years who presented to clinic for concussion care within 21 days post-injury. Data was collected and included demographics, sport in which they sustained their concussion, and rated concussion symptom using the Health Behavioral Inventory. Time from self-reported symptom resolution until medical clearance to return to play was evaluated.

Results: Of the 128 patients evaluated, 19 (15%) were injured during non-traditional/adventure sports with the average age of 13.4 years. Of those, 7 (37%) were female. The adventure sport group was significantly younger than the traditional sport group. Among the 3 groups, the adventure sport group had the highest proportion of patients with prior concussion history and loss of consciousness at time of injury. While there were no significant differences between groups in time from concussion to self-

reported symptom resolution, the adventure sport group had a significantly longer time from symptom resolution to medical clearance than the traditional sport group.

Conclusions: Despite limited differences in demographics, injury characteristics or medical history, adventure sport athletes took longer to receive medical clearance after self-reported symptom resolution compared to traditional sport athletes.

Significance: Future research may explore reasons for this disparity, which may be related to the lack of organized return-to-play protocols for this group of athletes or more conservative clearance decisions by treating physicians.

Acknowledgments: Children's Hospital of Colorado.

TOPIC: Epidemiology

STUDY: Other

An Analysis of Cycling Injury Distribution Comparing Presence or Absence of Motor Vehicles

Primary Author/Presenter: Lewis Tsai, MD

Karen Schlag, PhD and Namita Bhardwaj, MD

Affiliation: University of Texas Medical Branch.

Purpose: To examine whether cyclists in a crash involving an automobile are more likely to sustain an injury than in a crash without an automobile involved.

Methods: A national database was used to quantify the number and types of injuries sustained in both instances from 2009 to 2019. There was no restriction on age or gender. Chi-square analysis was then used to compare overall injuries and fractures involving different parts of the body in crashes in the traffic and non-traffic settings.

Results: Analysis showed that there was a significant, although weak, increase in the number of injuries sustained in traffic-related crashes (8.2%), as opposed to non-traffic related crashes (4.7%). However, there was not a significant difference in the type of injury the cyclist would sustain when comparing the 2 instances.

Conclusions: Cycling accidents where automobiles are involved lead to more fractures compared to accidents without automobiles. There is no significant difference in the type of fractures sustained though.

Significance: By knowing that traffic involved crashes lead to more injuries, road designers, event planners, or first responders can be better prepared knowing that if traffic is involved, they should expect an increased number of injuries, but not specific types.

Acknowledgments: NEISS-AIP database.

TOPIC: Ultrasound

STUDY: Other

Sonographic Assessment of Asymptomatic Patellar and Achilles Tendons to Predict Future Pain: A Systematic Review

Primary Author/Presenter: Rock Vomer, DO, DPT

Masaru Teramoto, PhD, MPH, Maddie O'Sullivan, MD, Jade Mulvey, BS, Sarah Eby, MD, and Daniel Cushman, MD
Affiliation: Duke University, Durham, North Carolina.

Purpose: The purpose of this systematic review and meta-analysis was to investigate the utility of Ultrasound (US) imaging as a method to identify future symptomatic Achilles and Patellar tendinopathy.

Methods: Broad search terms were used to conduct a comprehensive search in multiple databases. Inclusion criteria

were prospective studies of asymptomatic Achilles and patellar tendinopathy evaluations with US, follow-up clinical measurements, and English-language studies published after 2000. Exclusion Criteria were prior rupture or surgery, presence of rheumatologist disorder.

Results: This review demonstrated that the relative risk for development of injury from an abnormal patellar and Achilles US was 6.07 (95% CI = 2.88-12.81; $P < 0.001$) and 3.96 (95% CI = 2.21-7.09; $P < 0.001$), respectively. The positive and negative predictive values of an abnormal ultrasound finding were 27.2% and 92.0% for the Achilles' tendon, and 27.2% and 93.5% for the patellar tendon, respectively. Bias assessment revealed no definitive evidence of small-study effects. Sensitivity analyses demonstrated a low level of uncertainty from the findings.

Conclusions: This systematic review and meta-analysis demonstrated a consistent pattern of increased risk of developing Achilles and patellar tendon pain if an asymptomatic baseline US identified tendon abnormalities. The negative predictive value is quite high, but the positive predictive value is low.

Significance: This systematic review includes the latest studies on the topic and identifies positive and negative predictive values of abnormal US findings to predict future Achilles and patellar tendinopathy in asymptomatic subjects.

TOPIC: Musculoskeletal

STUDY: Other

A Quality Improvement: Improving Access to Musculoskeletal Care for the Underserved Population

Primary Author/Presenter: Rock Vomer, DO, DPT

Emma York, DO, Rayghan Larick, MS, Reagan Treadwell, MS, Abigail Bent, MS, and Chris Fungwe, MS

Affiliation: Duke University, Durham, North Carolina.

Purpose: Our Sports medicine and Physical Therapy clinic aims to improve student musculoskeletal education and patient access to PT and OMT services. Since the clinic's inception, we evaluated the impact volunteering has had on medical student musculoskeletal education and impact of access to these services.

Methods: Clinical outcomes were monitored using validated Patient Reported Outcome Measures. Post-visit satisfaction surveys were distributed to all patients. Educational change was assessed with student pretest/posttest surveys consisting of 6 items on a Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. Surveys were distributed to all student volunteers.

Results: A total of 17 MD and MPA students participated as volunteers in the clinic 11 participants completed the survey. Among participants, 72.7% ($n = 8$) were in the MD program and 27.3% ($n = 3$) were in the PA program. 63.3% ($n = 7$) of participants had heard of OMT prior to attending the clinic and 36.4% ($n = 4$) had not. Results revealed a statistically significant increase in participants' musculoskeletal learning between the pretest ($M = 2.76$, $SD = 0.94$) and posttest ($M = 3.79$, $SD = 0.71$), 95% CI [-1.44, -0.62], $t(10) = -5.57$, $P < 0.001$, $d = 1.24$. A total of 14 patients were seen in clinic for various musculoskeletal conditions over the course of 9 clinic sessions. A representative example of 2 patients was chosen to display how outcome measures were tracked.

Conclusions: Our project resulted in significant increases in participants' perception of knowledge and diagnosis of musculoskeletal disorders before and after volunteering in

the clinic. Preliminary patient outcomes reveal modest improvements in pain and disability scores among patients with consistent follow-up. Limitations of this study include limited sample size and consistency of patient follow-up.

Significance: The clinic improved student education in diagnosis and treatment of musculoskeletal disorders and increased exposure different healthcare professionals. Our clinic successfully brought PT and OMT care to an underserved population.

Acknowledgments: Thank you to the EVMS HOPES Free Clinic for the opportunity to creat this clinic.

TOPIC: Concussion

STUDY: Cohort

Acute Sleep Quantity Impact on Time to Symptom Free and Return to Play in Sport-Related Concussions

Primary Author/Presenter: McKensie Wahl, MD

Kevin DuPrey, DO, Caitlin A. Gallo, BS, and Thomas Buckley, EdD, ATC

Affiliation: Crozer Health, Springfield, Pennsylvania.

Purpose: Clinical predictors of concussion recovery remain elusive. Instrumented sleep outcomes may predict recovery, but are not widely available. Herein, we evaluated the association between self-reported acute sleep quantity and time to symptom free (SF) and return to play (RTP) in collegiate athletes.

Methods: There were 56 college athletes (30 Female) who self-reported number of hours slept nightly during the acute phase (3 days) post-concussion. Mean number of hours slept was the predictor and time to SF and RTP were the outcomes in a linear regression while controlling for sex, concussion history (yes/no), loss of consciousness, post-traumatic amnesia, and initial graded symptom (0-132) severity.

Results: For all participants, the mean time to SF was 5.7 + 3.3 days (Range: 0-29 days) and time to RTP was 14.3 + 4.9 days (Range: 6-48). The acute symptom severity was 25.7 + 18.9 (Range: 0-103), and 57.1% (32/56) had a prior concussion. After controlling for covariates, the mean number of hours slept over the first 3 days (7.7 + 1.4 hours, Range: 5-11.2) was not associated with time to SF ($P = 0.640$, $R^2 = 0.085$) or time to RTP ($P = 0.218$, $R^2 = 0.153$). As either high or low levels of sleep could be problematic, an exploratory quadratic regression was also performed; however, the mean number of hours slept over the first 3 days was not predictive of time to SF ($P = 0.458$, $R^2 = 0.027$) or RTP ($P = 0.495$, $R^2 = 0.029$).

Conclusions: Clinically feasible measures of post-concussion sleep quantity did not predict time to symptom free or return to play, while controlling for common confounding variables, in this study of intercollegiate student-athletes. While clinicians may still want to consider sleep in concussion recovery, this may require either validated questionnaires administered daily or the use of instrumented measures to acquire more sophisticated outcome measures.

Significance: Clinicians should continue to consider known predictors of prolonged recovery (e.g., age, initial symptom burden) during concussion management for collegiate athletes, but self-reported sleep quantity does not appear to predict recovery timeline.

TOPIC: Musculoskeletal

STUDY: Cohort

Does Joint Size Impact Injection-Related Pain?

Primary Author/Presenter: Matthew W. Wise, DO

Caitlin Faust, BS, Sarah Pietruszka, MD, Joy English, MD, Nicholas Monson, DO, Chris Gee, MD, Mark Sederberg, DO, and Daniel Cushman, MD

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

Purpose: Clarification is needed of clinical variables that impact pain during joint injections. We aim to investigate whether injection-related pain is higher or lower based on joint size.

Methods: Consecutive patients were recruited from 2 orthopaedic clinics and were asked about the painfulness of their ultrasound-guided joint injection after the fellowship-trained sports medicine physician left the room. All injections used local anesthetic. Univariate analysis was used to identify the painfulness of the procedure relative to joint size: small, intermediate, and large.

Results: A total of 241 patients underwent an injection (183 large joints, 39 intermediate joints, and 19 small joints). 58.9% of patients were female, 15.4% were performed by a trainee, and 13.3% had a trainee observe. The mean age of the patients was 61.3 ± 14.7 years, with a body mass index (BMI) of 29.5 ± 7.8 kg/m². Mean procedure-related pain scores, on a scale of 0 to 10, were 3.6 ± 0.7 , 2.1 ± 0.3 , and 2.3 ± 0.1 for small, intermediate, and large joints, respectively. Small joint injections were more painful for patients than large joints ($t = 2.67$, $P = 0.008$). Inclusion of age, sex, and BMI in the model did not alter the significant outcome.

Conclusions: On univariate analysis, patients experienced more pain with injections into small joints compared to injections into larger joints. Since injectate volumes were similar for small and intermediate sized joints, one can surmise that small joints with lower-volume joint capsules may have greater pain from the capsular stretch caused by an injection.

Significance: No studies have evaluated the role of joint size on injection-related pain. A better understanding of factors that impact injection-related pain helps practitioners better counsel patients and ideally reduce their perceived pain.

TOPIC: Other

STUDY: Other

Factors Associated With Concussion & Fracture in Youth Mountain Biking: Analysis of National Database

Primary Author/Presenter: Emily Woods, MD

Rachel Anders, BS, Masaru Teramoto, PhD, MPH PStat(R), Daniel Cushman, MD, Chris Spencer, Meredith Ehn, DO, and Stuart Willick, MD

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

Purpose: To promote safety in youth mountain biking, the National Interscholastic Cycling Association (NICA) and the University of Utah successfully launched an injury surveillance system in 2018. The aim of this study was to examine factors associated with concussion and fracture in youth mountain biking.

Methods: Data were collected via the NICA ISS in the 2018 to 2021 seasons, over 4 years. Data included body parts and diagnoses of injuries, along with rider characteristics and riding conditions. Data analysis consisted of descriptive statistics, independent t -tests, and contingency table analyses

with calculations of a relative risk (RR) and its 95% confidence interval (CI).

Results: Of 2083 total injury events reported over 4 years, 480 (23.0%) and 594 (28.5%) involved concussions and fractures, respectively. A significantly higher rate of concussions occurred during races than during practice (32.1% vs 19.6%; $P < 0.001$), with about a 1.6 times higher risk during races (RR = 1.64; 95% CI = 1.40, 1.93). Downhill trail incline was significantly associated with concussion ($P = 0.002$), with nearly twice the risk as uphill (RR = 1.86; 95% CI = 1.19, 2.89). Fractures resulted in a significantly longer time-loss than non-fracture injuries (53.9 ± 38.7 days vs 16.6 ± 29.8 days; $P < 0.001$). Male riders showed a significantly higher rate of fractures than female riders (30.7% vs 21.6%; $P < 0.001$), with about 1.4 times higher risk for males (RR = 1.42; 95% CI = 1.18, 1.71). A significantly higher rate of fractures occurred during practice than during races (32.0% vs 18.2%; $P < 0.001$), with about a 1.8 times higher risk during practice (RR = 1.78; 95% CI = 1.46, 2.17).

Conclusions: Concussions and fractures are 2 of the more serious injuries seen in youth mountain biking. Specific rider characteristics and circumstances are potentially associated with these injuries. Significant risk factors for sustaining a concussion include a race setting and riding downhill, whereas those for sustaining a fracture include male sex and a practice setting.

Significance: Concussions and fractures are common in this sport. Risk factors differ between these injuries. Safety strategies need to account for these differences in order to improve safety. We are actively strategizing data-driven, injury reduction intervention.

TOPIC: Epidemiology

STUDY: Other

Descriptive Epidemiology of Snowmobile Injuries Presenting to U.S. Emergency Departments in 2012-21

Primary Author/Presenter: Emily Woods, MD

Masaru Teramoto, PhD, MPH PStat(R), Daniel Cushman, MD, Rachel Anders, BS, and Stuart Willick, MD

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

Purpose: While snowmobiling provides recreational opportunities, it can lead to a variety of injuries that are often acute and severe in nature. Our purpose was to characterize snowmobile injuries presenting to emergency departments in the United States over a 10-year period from 2012 to 2021.

Methods: Data were retrieved from the National Electronic Injury Surveillance System (NEISS). Injuries sustained during snowmobiling that led to an ED visit were included. Sample weights were used to calculate national estimates of the injuries. Data analysis included descriptive statistics, calculations of a confidence interval, and Pearson χ^2 tests with the Rao and Scott correction for the survey design.

Results: Over the 10-year period from 2012 to 2021, a total of 970 injury cases were reported, with a national estimate of 61166 injury cases (95% CI = 27800-94532). Most injury cases were reported in December through March, with the highest amount reported in February (33.2%). The mean age of injury was 36.1 years, including 13.0% under 18 years old, and 76.4% in males. Injury in the upper trunk was the most common (15.6%), followed by that in the lower trunk (13.4%), head (12.0%), and shoulder (11.6%). The most

common diagnosis was fracture (28.9%), followed by strain/sprain (18.0%), and contusion/abrasion (17.2%). Injured males had a significantly higher percentage of injury in the shoulder than did injured females (13.3% vs 5.9%; $P = 0.008$). Meanwhile, female gender was significantly associated with a higher percentage of knee injury (13.0% vs 6.3%; $P = 0.007$). Injured persons younger than 18 years had a significantly higher percentage of concussion (7.9% vs. 4.3%; $P = 0.013$).

Conclusions: Snowmobiling can cause a variety of injuries, with some of those being severe. Injuries in the upper and lower trunks are most reported, while fracture is the most common diagnosis. Gender and age may be associated with certain types of injuries. The findings in this study could be used to understand specific mechanisms and factors associated with snowmobile injuries for future studies.

Significance: There is little research dedicated to understanding the injury patterns that can be expected with snowmobiling. This study is significant as it helps to define most common injuries that can be expected and help to steer future research directions.

TOPIC: Training

STUDY: Survey

The Impact of Social Media Presence on Primary Care Sports Medicine Fellowship Recruitment

Primary Author/Presenter: Tiana Woolridge, MD, MPH

Celina de Borja, MD, Cooper Bloyd, MD, MS, Madelyn Taylor, MD, and Nicolas Hatamiya, DO

Affiliation: UCSF, San Francisco, California.

Purpose: There has been increased use of social media by medical training programs. This study aimed to determine the prevalence of PCSM fellowship program social media use and its impact on recruitment. This study also examined potential barriers to social media interaction between programs and applicants.

Methods: Cross-sectional study design using publicly available online sources to identify social media accounts for PCSM programs. Fellowship directors were surveyed regarding their program's use of social media. Applicants and fellows were surveyed to determine their interaction with PCSM fellowship social media accounts and how social media influenced perception of the programs.

Results: Of 211 PCSM fellowship programs identified on the AMSSM website, 83% had a social media presence. Sixty-seven programs had dedicated PCSM fellowship accounts. Most commonly used platforms were Instagram (43%), Facebook (30%) and Twitter (24%). One hundred seven programs were mentioned in departmental social media accounts not specific to the fellowship. Fifty-eight fellows and applicants completed the survey. 95% reported using social media. 35% reported following PCSM accounts. Of those who did not, the most common reason was lack of awareness of these accounts. 22% of respondents indicated that social media positively influenced their perception of a program and its rank list position, while the remainder reported a neutral effect. Seventy fellowship directors responded. 47% reported their program did not have official guidelines for appropriate social media use. Most commonly reported barriers for social media use included lack of time (32%), resources (13%), or oversight (11%).

Conclusions: The majority of PCSM fellowship programs, fellows, and applicants are present on social media. Social media presence can positively impact an applicant's view of a program, however, applicants' lack of awareness of these accounts may serve as a barrier for interaction. Universal guidelines for appropriate social media use may help increase utilization of social media platforms.

Significance: Previous studies have shown social media has a positive impact on trainee recruitment. This study highlights the benefit of social media for PCSM fellowship recruitment, which may be useful when in-person recruitment opportunities are limited.

Acknowledgments: The investigators would like to acknowledge PCSM fellowship program coordinators for assisting with the distribution of surveys to fellows and program directors.

TOPIC: Musculoskeletal

STUDY: Cohort

The Effect of Intra-articular Prolotherapy on Functional Outcomes Scores in Knee Osteoarthritis

Primary Author/Presenter: Emma York, DO

Rock Vomer, DO, DPT

Affiliation: Eastern Virginia Medical School, Norfolk, Virginia.

Purpose: Knee Osteoarthritis is a common chronic condition leading to pain and debility. Prolotherapy is a safe and cost-effective treatment option. Our team conducted a case series to examine the effect of Prolotherapy on functional measures and quality of life in patients with knee osteoarthritis.

Methods: Our case series included both male and female patients ages 50 to 85 years old with a prior diagnosis of knee osteoarthritis and moderate pain. The patients completed baseline WOMAC and EQ5D surveys and received an ultrasound guided intra-articular Prolotherapy injection. The patients were then followed up by Telehealth at 1, 2 and 3 months post procedure with repeat WOMAC and EQ5D surveys.

Results: WOMAC results revealed significantly improved functional scores from baseline period ($M = 40.73$) to the 1-month ($M = 27.71$), 2-month ($M = 31.5$) and 3-month ($M = 29.79$), observed power = 0.99. Participants reported significantly lower pain scores between the baseline period ($M = 11.57$) compared to the 1-month ($M = 5.69$), 2-month ($M = 5.77$) and 3-month ($M = 6.54$) periods. There was no statistical significance across time in participants' EQ5D scores. The repeated-measures ANOVA revealed no statistically significant differences in participants scores between the baseline ($M = 64.4$), 1-month ($M = 68.93$), 2-month ($M = 68.47$), or 3-month ($M = 68.33$), observed power = 0.31. There was no statistically significant differences in participants WOMAC stiffness scores between the baseline ($M = 5.33$), 1-month ($M = 3.57$), 2-month ($M = 4.43$), or 3-month ($M = 4.36$) periods, observed power = 0.73.

Conclusions: The results support a statistically significant improvement in patients' self-reported functioning and pain scores between the baseline and 1-month, 2-month, and 3-month periods. The significant improvement in function occurred between the baseline and 1-month time periods and the pain reduction was sustained throughout the 2-month and 3-month periods. The results revealed no

significant change in participants' EQ5D and WOMAC stiffness scores.

Significance: Our study supports prolotherapy as an effective treatment option to improve pain and function in knee osteoarthritis. The study could be repeated with a large sample size to further investigate the effects of prolotherapy on quality of life measures.

TOPIC: Musculoskeletal

STUDY: Cohort

UCL Throwing Injuries in Non-Professional Baseball Players and Associated Outcomes: A 14 Year Retrospective Study

Primary Author/Presenter: Jason Zaremski, MD

Marissa Pazik, MS, LAT, ATC, CSCS, William Dodd, BS, Binh Nguyen, BS, Harold Hunt, MD, and MaryBeth Horodyski, EdD, ATC, LAT

Affiliation: University of Florida, Gainesville, Florida.

Purpose: The purpose of this study was to evaluate treatment modality (surgical versus non-operative) of Medial Ulnar Collateral Ligament (UCL) injuries in throwing athletes by comparing type, severity, and location of UCL injury.

Methods: A retrospective study (years January 1, 2008 to June 30, 2022) including baseball UCL injury patients, ages 11 to 25 years, were evaluated at our institution. ICD and CPT codes were used to identify the patient population. Data points included sex, age at time of injury, severity and location of UCL injury, growth plate status, and operative vs conservative management.

Results: One hundred forty-five baseball players with a mean age of 16.7 ± 2.5 were included in the study. Ninety-eight players were treated conservatively, 47 had UCL reconstruction (UCL-R). A significant difference was found for age related to treatment type, UCL-R versus conservative treatment ($P = 0.011$). There were 33 athletes with open growth plates and 113 with closed growth plates at time of UCL injury. Athletes with closed growth plates were significantly more likely to undergo UCL-R than athletes with open growth plates ($P = 0.003$). A comparison of advanced imaging for 105 athletes resulted in no significant differences between UCL injury location (41 distal, 35 proximal, 29 combined tear locations) and treatment type. No significant differences were noted for athletes ($n = 10$) sustaining proximal flexor forearm injuries combined with an UCL injury.

Conclusions: Older athletes with closed growth plates and throwing related UCL injuries in baseball were more likely to be treated with surgical intervention as opposed to non-operative management. Our data reflects the importance of early detection to potentially decrease progression of injury; thus, potentially reducing surgical intervention in baseball players.

Significance: Increasing our understanding of UCL injuries including associated characteristics, such as location and severity of UCL injury, will improve treatment algorithms and return to play guidelines in baseball.

TOPIC: Concussion

STUDY: Cohort

Examining Injury After Return to Sport Following Concussion Clearance in Youth Athletes

Primary Author/Presenter: Tracy Zaslow, MD

Sarah Adams, BS, Mia Katzel, DPT, and Tishya Wren, PhD

Affiliation: Cedars-Sinai Kerlan-Jobe Institute, Santa Monica, California.

Purpose: The purpose of this study is to examine the incidence and risk factors for post-concussion injury after return to sport in pediatric patients. Although studied in older athletes, it is unknown whether younger athletes also have an elevated risk of musculoskeletal injury post-concussion.

Methods: Weekly survey data were obtained for patients aged 11 to 17 years after medical clearance to return to sport after concussion. Surveys were collected for 12 weeks about sleep patterns, sport participation, and injury. If they reported an injury, more questions about the injury were ascertained. Factors including age, sex, and time to clearance were also evaluated.

Results: Of 24 eligible subjects, 19 reported no injuries and 5 reported injuries. Two subjects reported 2 injuries each and 6 of 7 incidences were lower extremity with one concussion at week 11. When comparing the injury and non-injury groups, the hours of sleep per night and hours of sports participation per week were not significantly different ($P > 0.34$). The hours of sleep both during the week of and week before an injury were less than the average, but neither sleep nor sport hours during the week of injury or the week before were significantly different from the average ($P > 0.42$). There were no significant differences in injury incidence by age, gender, or time to clearance. When compared to 89 non-concussed patients over a 12-week period, the rate of injury was similar, 21.4% versus 20.8%.

Conclusions: Injury following return to sport after concussion clearance was not related to age, gender, sleep/activity patterns, or time to clearance from concussion. This may reflect the conservative management of concussion for this population, which had a median clearance time of 27 days. The rate of injury was similar between the non-concussed patients and the concussed patients, indicating appropriate return to sport protocol.

Significance: By comparing the injury rates of non-concussed and concussed athletes, evaluation of concussion protocols can be observed. Similar injury rates between the cohorts indicates current return to sport protocol is appropriate for injury prevention.