2024 AMSSM Research Podium Presentations

Topic: Gender-Affirming Care
Study Type: Cohort

Testosterone Levels Among Transgender Women on Gender-affirming Hormone Therapy

Submitting Author/Presenter: Emily Miro, MD, MPH
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Affiliation: University of Utah.

Purpose: Little is known regarding duration of gender-affirming hormone therapy (GAHT) required to suppress testosterone within the range required for participation in women's sport, often less than 2.5 or 5 nmol/L. This study aimed to elucidate trends in testosterone levels among transgender women on GAHT.

Methods and Study Design: Participants included in our retrospective chart review were seen at an academic hospital between 2003 and 2023 with record of at least one ICD9/10 diagnosis code associated with transgender individuals. We included patients on combined estradiol and spironolactone who had testosterone lab values in our electronic medical record obtained after starting GAHT. Mean testosterone values were calculated.

Results: A total of 261 patients met study criteria. Patients' mean testosterone level on initial testing after starting GAHT was 6.04 nmol/L (95% CI [5.57, 6.51]). After 12 months on GAHT, the 261 patients demonstrated a mean testosterone level of 3.39 nmol/L (95% CI [3.00, 3.78]). After 24 months, 112 patients had testosterone levels drawn with a mean level of 3.90 nmol/L (95% CI [3.19, 4.61]). At initial testing, 37.2% of patients had higher testosterone values than the 5 nmol/L threshold, while 48.3% were higher than the 2.5 nmol/L threshold. At one year, 19.5% and 23.8% were above the respective thresholds, while 22.3% and 25.0% were above at 2 years.

Conclusions: Many organizations have testosterone-based policies restricting sports participation of transgender women. Policies vary in testosterone threshold and length of testosterone suppression. Testosterone levels less than 5 nmol/L or 2.5 nmol/L are required by many organizations. These data suggest that there is a wide variability in testosterone levels, and a large percentage of patients still have supra-threshold values at one and 2 years.

Significance: Further understanding of duration of GAHT and degree of endogenous hormone suppression required to meet guidelines for participation in women's sports is needed.

Topic: Ultrasound
Study Type: Cohort

Prevalence of Sonographic Abnormalities in Patellar Tendons, Achilles Tendons, and Plantar Fasciae in 473 NCAA Athletes

Submitting Author/Presenter: Derek Stokes, MD
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Purpose: Tendinopathy and fasciopathy are common conditions affecting athletic performance. The purpose of this study was to evaluate the prevalence of sonographic abnormalities in the patellar tendons, Achilles tendons, and plantar fasciae of NCAA Division I student-athletes.

Methods and Study Design: This was a prospective, observational study. Protocolized ultrasound video scans were performed on bilateral patellar tendons, Achilles tendons, and plantar fasciae of consented athletes from 3 Division I programs during pre-season physicals. Blinded assessment of the videos was then performed, identifying the presence of hypoechogenicity, morphologic thickening, and neovascularity.

Results: A total of 473 athletes from 3 institutions over 2 years of data collection were included (57.7% females; 20.1 ± 1.6 years of age; 23.1 ± 2.8 kg/m^2 of body mass index; 9.4 ± 3.6 years of sport experience). Of the 946 scans for each structure (right and left), sonographic abnormalities were seen in 334 (35.3%) patellar tendons, 87 (9.2%) Achilles tendons, and 29 (3.1%) plantar fasciae. Significant predictors for patellar tendon abnormalities included (prevalence ratio [PR] with 95% confidence interval [CI]): age (PR = 0.92 [95% CI = 0.86, 0.98], $P = 0.023$), male gender (PR = 1.44 [95% CI = 1.12-1.86], $P = 0.005$), explosive sport (PR = 4.09 [95% CI = 1.68-9.98], $P = 0.002$), running sport (PR = 3.76 [95% CI = 1.50-9.42], $P = 0.005$), and skill-based sport (PR = 2.95 [95% CI = 1.14-7.59], $P = 0.025$). Age was also a significant predictor for abnormalities of the Achilles tendon (PR = 1.28 [95% CI = 1.08-1.47], $P = 0.003$) and plantar fascia (PR = 1.34 [95% CI = 1.06-1.71], $P = 0.016$).

Conclusions: Ultrasound abnormalities are common in tendon and fascial structures of collegiate athletes, especially in patellar tendons. Factors, such as age, gender, and type of sport participation, could be associated with abnormal ultrasound findings in these structures. Future studies are required to identify the significance of sonographic abnormalities in these structures, correlation with injury risk, and utility of preventative modalities.

Significance: Tendinopathy and fasciopathy are common injuries in athletes. Ultrasound is useful for identifying abnormalities and may also provide valuable information regarding the health of tendons and fascial tissues, even in the absence of symptoms or injury.

Topic: Load Management

The Relationship Between Load Management and Injury Risk in the NBA: A 9 Year Analysis

Submitting Author/Presenter: John DiFiori, MD, FAMSSM
    Mackenzie Herzog, Alexandra Chretien, Rahul Gondalia, Kristin Shiue, and Christina Mack
    Affiliation: HSS.

Purpose: The use of load management has been proposed to reduce injury risk. The purpose of this study was to assess relationships in the NBA between managing load by selectively reducing game participation and injury risk, including factors such as schedule density, travel, and cumulative NBA participation.

Methods and Study Design: A 9-year retrospective study of NBA players (2014-15-2022-23 seasons) was conducted using the League-wide EMR. The League requires entry for games missed using uniform criteria for injury, illness, or load management (listed as "rest" or "load management"). Cox proportional hazards models and Poisson regression were used to analyze injury risk for players who missed games for load management.

Results: One thousand two hundred twenty-six player seasons contributing 1,538,917 player-minutes of gameplay were included. Games missed for load management were found to increase over the study period. Among starter-level players who missed games for load management, there was no significant difference in injury risk compared to players who did not miss games for load management (1-2 games missed: HR = 1.24, 95% CI: 0.92-1.65; 3-5 games missed: HR = 0.91, 95% CI: 0.39-1.80; 6+ games missed: HR = 2.16, 95% CI: 0.53-5.78). Results were adjusted for age, prior injury history, and average minutes played per regular season game in the previous season, current season, and career. Similarly, there was no significant difference in injury risk considering schedule density (including back-to-back games, and games over 7- or 14-day windows) or travel (total miles or time zones). Study limitations include inability to assess non-game training load (data reporting not required), other potential internal and external load measures, and player-level factors (eg, intensity of play).

Conclusions: This analysis of available data within the NBA did not demonstrate that managing load by reducing game participation decreases injury risk, even when adjusted for cumulative injury history, per-minute game participation, and age. Although NBA players have an average of 3 to 4 games each week, future studies that include non-game load, other internal and external load measures, and analysis of individual player factors are needed.

Significance: Sport-specific data is essential to injury prevention. This first study of load management and injury risk using NBA data emphasizes the complexity of injury prevention and the need for additional research to address these issues better.

Topic: Pediatrics
Study Type: Cohort

Using the Fat Pad Sign in Pediatric Occult Elbow Fractures: Is It As Reliable As We Think?

Submitting Author/Presenter: Logan Garfield, MD
    Stephen Chenard, MSc, William Hollabaugh, MD, Jacquelyn Pennings, PhD, PStat, and Andrew Gregory, MD

Affiliation: Vanderbilt University Medical Center, Nashville, TN.

Purpose: Elbow fractures account for about 15% of pediatric fractures but are often occult. The radiographic fat pad sign (FPS) is frequently used to assist with this diagnosis. Our study evaluated the sensitivity, specificity, and predictive value of the FPS in diagnosing occult elbow fractures in children.

Methods and Study Design: Single-center retrospective cohort study of patients 2 to 21 years-old with acute elbow injury who had an elbow x-ray from 2013 to 2023. We identified the anterior FPS (AFPS), posterior FPS (PFPS), fracture, and fracture type on initial and follow-up x-rays. For occult fractures initially classified as a clinical diagnosis, bony healing on follow-up x-ray was used for confirmation of elbow fracture.

Results: Seven hundred fifty-two patients met initial inclusion criteria. After randomization of cases via random number generator, 204 total cases were reviewed and 50 (24.51%) were excluded: loss-to-follow-up, nonapplicable indications for x-ray, lack of mention of a fat pad. Of the 154 cases included in the final analysis, 88 patients (57.1%) had an elbow fracture. Ninety-nine patients (64.3%) had a positive FPS. The sensitivity of a positive FPS was 94.3% (95% confidence interval [CI], 87.2%-98.1%) with a specificity of 75.8% (95% CI, 63.6% 85.5%) and a negative predictive value (NPV) of 91% (95% CI, 80.9%-96%). The sensitivity of an AFPS was 83.9% (95% CI, 74.5%-90.9%) with a specificity of 84.8% (95% CI, 73.9%-92.5%) and a NPV of 80% (95% CI, 71%-86.7%). The sensitivity of a PFPS was 62.1% (95% CI, 51.0%-72.3%) with a specificity of 89.4% (95% CI, 79.4%-95.6%), and a NPV of 64.1% (95% CI, 57.4%-70.3%).

Conclusions: Our study suggests that the presence of an AFPS on elbow x-ray strongly predicts an occult elbow fracture. The absence of a PFPS is less reliable in ruling out an occult fracture, but if present, strongly predicts a fracture. When combined, they are even more predictive of fracture. The location of fracture cannot be distinguished based on the FPS. Therefore, clinicians should rely on the history and physical exam to determine fracture location.

Significance: Our study presents a novel contribution to the literature on the use of the FPS in diagnosing pediatric occult elbow fractures. Our findings support the value of the AFPS and that a present FPS does not correlate with elbow fracture location.

Acknowledgements: We would like to thank the Department of Orthopaedic Surgery and Pediatrics and the Department of Biostatistics at Vanderbilt University Medical Center for their part in facilitation of this project.

Topic: Gender Reporting
Study Type: Other

Gender and Sex Reporting in Sport and Exercise Medicine Original Research

Submitting Author/Presenter: Anna Buehler, MD
    Lucianne Olewinski, MD and Karin VanBaak, MD
    Affiliation: University of Colorado, Aurora, Colorado.

Purpose: Gender and sex are meaningful demographic data with specific definitions. While there are guidelines (Sex and Gender Equity in Research-SAGER) for reporting this

information, it is often done unclearly or inaccurately. We analyzed this problem in sport and exercise medicine (SEM) original research.

Methods and Study Design: Original research articles published in 2020 in 3 SEM journals (BJSM, MSSE, AJSM) were reviewed to extract participant numbers by gender and sex. We analyzed how well articles adhered to SAGER guidelines, by evaluating whether demographic data were reported at all; and if so whether by gender, sex or inappropriate use of both terms interchangeably; and in binary or nonbinary categories.

Results: Data were extracted from 579 articles representing 1,693,304 participants. 45.6% of participants were women, girls or females and 54.4% of participants were men, boys or males. 96.2% of articles reported gender and/or sex of participants. Of these articles 65.6% reported sex only, 15.7% reported gender only and 14.9% reported sex and gender interchangeably. No articles declared an intention to collect both gender and sex, so this was deemed interchangeable use of terms. Due to significant variability and lack of specific reporting, we were unable to collect data on how sex and gender were defined. 3.8% of articles did not report any gender or sex, but we inferred that participants were men/male due details such as the referenced sport or league. The only article that included transgender categories recruited only transgender participants and used generally unaccepted terminology to describe participants ("transmen" and "transwomen" rather than "transgender men" and "transgender women").

Conclusions: The recommended approach to gender/sex reporting in not clearly followed in much of SEM research. Men and males are considered the default participants. It is common to use "gender" and "sex" interchangeably and uncommon to identify both the sex assigned at birth and gender of participants, or to report how sex and gender of participants is determined. People who are transgender are not well represented in SEM research.

Significance: Accurate collection and reporting of sex and gender demographic data is important to appropriately represent research participants. This allows researchers to identify well-represented and under-represented groups and improve research translation.

Acknowledgements: Brittany Becker, MD.
Topic: Epidemiology
Study Type: Other

Epidemiology of Ice Hockey Versus Roller Hockey-Related Injuries in the United States Emergency Departments 2013-2022

Submitting Author/Presenter: Nathan Michalak, MD
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Purpose: We aim to compare injury demographics in ice hockey (metal skates, ice) vs roller hockey (wheeled skates, dry surface). Both sports share similarities in rules and equipment, but differences in surface, skating mechanics and legality of body checking could provide insight for safety recommendations.

Methods and Study Design: Data on 10906 ice hockey and 615 roller hockey related injuries contained within the National Electronic Injury Surveillance System were analyzed over a 10-year period (January 2013-December 2022). Ice hockey included product codes 1279 ("ice hockey") and 3272 ("hockey"). Roller hockey included product codes 3245 ("street hockey") and 5032 ("roller hockey").

Results: Injuries were most common in the 11 to 15 age group in both ice hockey and roller hockey (38.1% and 34.2%, respectively). Males represented the majority of patients in both ice hockey and roller hockey (88.6% and 80.1%, respectively). Caucasian race constituted about 56.6% and 65.3% of all cases in ice and roller hockey, respectively. The 3 most common locations for injury in ice hockey were head (20.9%), face (12.3%) and shoulder (12.1%), while for roller hockey they were head (17.6%), face (16.6%), ankle (8.9%). The 3 most common types of injury in ice hockey were fracture (18.7%), laceration (17.8%), and contusion (12.5%), while for roller hockey they were fracture (18.1%), strain/sprain (16.4%), and laceration (16.3%).

Conclusions: Head and face injuries predominated in both sports, suggesting rule adjustments for facial protection. Ice hockey exhibited more shoulder injuries, attributed to its physicality and board/body checking, which is prohibited in roller hockey. Roller hockey had increased ankle injuries, possibly linked to wheeled skate maneuverability and faster pace due to less stoppage time. Fractures were the most common injury type, with lacerations also common.

Significance: Analyzing these injury patterns informs targeted safety regulations to prevent common injuries in each sport. Adjusting face equipment rules benefit players in both sports. Special attention to prevent ankle sprains in roller hockey is warranted.

Topic: Heat Illness
Study Type: Cohort

Correlations Between WBGT Temperatures and NWS Heat Index Readings in Secondary School Settings

Submitting Author/Presenter: Thomas Jason Meredith, MD
Adam Rosen, PhD, Colleen Vogel, MS, and Samuel Wilkins, PhD
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Purpose: Wet Bulb Globe Temperature (WBGT) is considered best practice to monitor heat stress for sports. Many schools have relied on heat index (HI) values to make decisions about practices and competitions. The purpose of this study was to determine the relationship between WBGT readings and HI values.

Methods and Study Design: Cohort design. ATCs recorded daily pre-event WBGT (pWBGT) readings and highest recorded WBGT (hWBGT) readings during activity using Kestral 5400 devices. WBGT data was submitted electronically daily and were date and time matched with HI data from the nearest NWS. Pearson r correlations were calculated to determine relationship between pWBGT and hWBGT readings and NWS HI values (alpha < 0.05).

Results: Thirty-eight high school athletic trainers participated in the study, recording a total of 504 unique data entries (mean pWBGT: 78.94 ± 6.72, hWBGT 81.36 ± 6.4, NWS HI: 89.39 ± 9.94). A positive strong correlation was calculated between pWBGT reading and HI reading (r =

0.768, $P < 0.001$) and hWBGT reading during activity and HI reading ($r = 0.779$, $P < 0.001$). Thirty-four (6.7%) total pWBGT readings were reported in the "black" range. All data was collected in WBGT geographic region 2. Green was the most frequent pWBGT category recorded (55.2%), followed by Yellow (28.3%), Black (6.7%), Orange (6.3%), and finally Red (2.0%). Most athletic trainers reported measuring WBGT on artificial turf (73.9%), followed by natural grass (20.6%), concrete (5.0%) and dirt (0.4%). Athletic trainers reported 50 cases of heat cramps, 2 cases of heat syncope, 11 cases of heat exhaustion, and no cases of heat stroke during the reporting period.

Conclusions: A strong positive correlation was found between pWBGT and HI, as well as hWBGT and HI. Despite this correlation, in some cases where "red" and "black" WBGT readings (highest risk for heat illness) were measured while HI measured less than 90 degrees. This HI would indicate the least risk for participating in outdoor sports. Differences in these risk calculations could impact athlete health through increased risk for exertional heat illness.

Significance: Team physicians should encourage their schools to use WBGT to measure heat stress in outdoor activities to mitigate the risk of heat illness for their student athletes.

Topic: Epidemiology
Study Type: Cohort

Comparison of Injuries Sustained on Grass and Artificial Turf by USL1 Mens Soccer Team. Part 2: Total Athlete Expos

Submitting Author/Presenter: Michael Osterholt, MD
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Purpose: Athlete safety on artificial turf (AT) playing surfaces is a reoccurring topic for debate. This study aims to analyze and compare the incidence, type, and location of injuries sustained on AT and natural grass (NG) playing surfaces for a United Soccer League, League 1 (USL1) men's soccer team.

Methods and Study Design: Union Omaha's ATC documented injury data including event location, anatomic location of injury, and type of injury sustained. Team physicians retrospectively reviewed data for 3 USL1 seasons (2020-2022). Injury incidence rates, calculated with 95% confidence intervals, were reported in terms of 1000 athlete exposures. Exposure was an athlete's participation in one practice session or match.

Results: There were 3444 exposures on NG and 5550 exposures on AT over the 3-year period. 295 injuries were registered on AT versus 259 on NG. Overall incidence of injuries was 53.15 per 1000 exposures on AT compared to 75.20 per 1000 exposures on NG (Incidence ratio 0.71, P value 0.001). Subgroups for location of injury comparing incident rate on AT to NG: Head/neck 2.88, 7.55 (IR 0.38, P 0.002), Upper limb 1.98, 4.68 (IR 0.43, P 0.030), Trunk 6.13, 7.26 (IR 0.84, P 0.520), and Lower limb 42.16, 55.75 (IR 0.76, P 0.004). Subgroups for type of injury comparing

incident rate on AT to NG: Fracture/Bone Stress 0.54, 1.16 (IR 0.47, P 0.317), Joint(non-bone)/Ligament/Cartilage 10.81, 10.16 (IR 1.06, P 0.771), Muscle/Tendon 28.47, 33.39 (IR 0.85, P 0.193), Contusion 8.83, 22.36 (IR 0.39, P 0.001), laceration/Skin Lesion 2.70, 2.61 (IR 1.03, P 0.936), Central/Peripheral Nervous System 1.44, 3.77 (IR 0.38, P 0.032), Other 0.36, 1.74 (IR 0.21, P 0.054).

Conclusions: Overall, the incidence of injuries per athlete exposure was significantly lower on AT than NG. Injuries subdivided into location demonstrate statistically lower rates of head/neck, upper limb, and lower limb injuries on AT. Additionally, with regards to type of injury, the rate of contusions and central/peripheral nervous system injuries were statistically lower AT.

Significance: Artificial turf playing surfaces have become more common as technology and engineering has advanced. This study suggests that new generation artificial turf may be safer than natural grass when comparing injuries on a professional men's soccer team.

Topic: Rehabilitation
Study Type: RCT

Timing of Physical Therapy in Adolescent Athletes With Spondylolysis: A Multi-Center Randomized Trial

Submitting Author/Presenter: Emily A Sweeney, MD
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Purpose: To assess the effectiveness of an immediate functional progression physical therapy program (IFPP) to treat adolescent athletes with an acute lumbar spondylolysis. We hypothesize athletes in the IFPP group will have quicker improvements than athletes who wait to start physical therapy (PT).

Methods and Study Design: This was a multi-center randomized trial. Adolescent athletes with acute lumbar spondylolysis diagnosed by MRI were randomized to IFPP or to usual care, (start PT once pain-free with ADLs). The Micheli Functional Scale (MFS), a 100-point scale, (0 = no pain/disability) was used to assess pain and disability at baseline, 1, and 3 months. Time out of sport and recurrence of back pain were assessed.

Results: Forty-five adolescent athletes (14.5 ± 1.6 years; 35% female) with a mean duration of symptoms 9 ± 6 weeks were enrolled; IFPP (n = 20) and usual care (n = 25). At baseline, athletes in both groups had similar levels of pain and disability on the MFS (IFPP 50 ± 17, usual care 52 ± 15; P = 0.70). At 1 month, athletes in the IFPP had a significantly lower score on the MFS (IFPP 16 ± 14, usual care 36 ± 22; P < 0.001). At 3 months, both groups had similar minimal MFS scores (IFPP 5 ± 10, usual care 10 ± 18; P = 0.13). Adolescent athletes in the IFPP passed predetermined return to sport criteria 33 days sooner (IFPP 69 ± 17 days, usual care 102 ± 34 days; P < 0.001). To date, no participants (0%) in the IFPP and 4 participants (16%) in the usual care group had

a significant recurrence of low back pain after returning to sport.

Conclusions: Starting PT immediately and progressing based on functional ability (IFPP) resulted in significantly quicker improvements in pain and disability for adolescent athletes with acute lumbar spondylolysis. Starting PT early, as opposed to waiting until the athlete is pain-free, led to a significantly sooner return to sport with fewer recurrences in back pain. In the future, we will assess imaging and one-year outcomes.

Significance: This is the first randomized trial to assess a controlled PT program for adolescent athletes with acute lumbar spondylolysis. These results suggest that beginning a controlled rehabilitation program sooner is a feasible option.

Acknowledgements: We want to acknowledge the AMSSM-CRN for grant funding for this project.

Topic: Concussion
Study Type: Cohort

Effectiveness of Helmet Add-on Shell Devices to Prevent Sport-related Concussion in High School Football Players

Submitting Author/Presenter: Erin Hammer, MD, MPH
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Affiliation: University of Wisconsin-Madison.

Purpose: There is limited evidence that aftermarket add-on shell devices for football helmets (ie, Guardian Caps [GCs]) are effective in reducing sport-related concussion (SRC). The purpose of this study was to determine if GC use was associated with a lower risk of SRC in high school football players.

Methods and Study Design: Football players from 40 high schools were recruited. Schools were classified as YesGC or NoGC based on GC use. Athletic trainers (ATs) reported football exposures and SRCs that occurred during practices and games. Negative binomial modeling with exposure offset was used to assess the difference in risk of SRC/1000 exposures, accounting for school setting (rural, suburban, urban) and enrollment.

Results: A total of 2480 players were enrolled (mean age 15.9 ± 1.2 years old; YesGC = 22 schools with 1367 players, NoGC = 18 schools with 1113 players). The athletes participated in 106,201 practice exposures and 22,077 game exposures during the 2023 regular season. During practices, 51 players sustained an SRC (YesGC = 26, NoGC = 25). There was no difference in the SRC rate sustained in practice between the YesGC (0.45 SRCs/1000 exposures) and NoGC (0.51 SRCs/1000 exposures) cohorts (RR 0.88, 95% CI [0.51-1.53], P value 0.66). During games, 108 players sustained an SRC (YesGC = 65, NoGC = 43), though neither cohort wore GCs during games. There was no difference in the rate of SRC sustained in games between the YesGC (5.30 SRCs/1000 exposures) and NoGC (4.38 SRCs/1000 exposures) cohorts (RR 1.21, 95% CI [0.76-1.90], P value 0.41).

Conclusions: In this sample of high school football players, GC use was not associated with a lower relative risk of SRC in practice. Similarly, there was no difference in the risk of SRC during games between the cohorts, though neither cohort wore GCs during the games.

Significance: Preventing SRC in football remains an elusive goal. High schools should consider investing in evidence-based strategies to reduce the incidence and morbidity of injury such as employing ATs in lieu of add-on shell devices for football helmets.

Acknowledgements: We want to thank all participating high schools, athletic trainers, players, coaches, and parents for their willingness to take part in this study.

Topic: Epidemiology
Study Type: Cohort

The NICA Injury Surveillance System: Details from 119,098 Student-Athlete-Years of Injury Data

Submitting Author/Presenter: Meredith Ehn, DO, DPT
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Purpose: To describe injury characteristics of youth mountain bike racers. The National Interscholastic Cycling Association (NICA) Injury Surveillance System (ISS) was implemented in 2018 to gather data on injuries in youth mountain bike racing, which can help inform targeted injury-prevention strategies.

Methods and Study Design: From 2018 to 2022 (5 seasons), a prospective, longitudinal ISS was developed that collects data weekly from NICA teams across the country using a web-based survey instrument designed in REDCap. A designated reporter from each team reports on injury characteristics, race and practice environments, and factors associated with a crash.

Results: In 119,098 student-athlete years over 5 years, there were 2,655 injury events (overall injury event proportion = 2.23%). The wrist/hand was the most common body part injured (23.2%), followed by head (concussion) (23.0%), and shoulder/clavicle (15.9%). Nearly half of all injury events (49.7%) resulted in a trip to an emergency room. About 75% of injuries occurred on trails familiar to the rider with many injuries attributed to "rider inexperience" and the "technical nature of the trail." Interestingly, male riders experienced a significantly higher proportion of upper limb injuries than females (57.6% vs. 49.6%, $P < 0.001$) and were more likely to sustain a fracture (Relative Risk = 1.38, 95% Confidence Interval = 1.17-1.63). Using data from the ISS, NICA implemented enhanced skills programs after the 2019 season; the overall injury event proportion significantly decreased from 2.79% in 2018-2019 to 2.05% in 2021-2022 ($P < 0.001$), which was equivalent to a 27% reduction in injury rate.

Conclusions: Acute traumatic injuries are common in youth cross-country mountain bike racing. One major cause of injury events appears to be inadequate skill level for technical trails at a given speed. Injury characteristics differ between males and females, possibly due to differences in rider speed, body position, and bike setup. Implementation of an enhanced skills training program was associated with decreased injury rates in youth riders.

Significance: To our knowledge, the NICA ISS is the largest database of mountain bike injuries in the world. Results from this ISS are being used to develop additional data-driven injury-prevention strategies that will help reduce injury rates in youth riders.

Acknowledgements: We would like to thank the NICA student-athletes, coaches, parents, and other stake-holders,

without whose participation this ISS could not be successful.

Topic: NCAA
Study Type: Cohort

Mental Health Screening With SMHAT-1 Compared to Diagnostic DSM Interview in Collegiate Athletes

Submitting Author/Presenter: Vicki Nelson, MD, PhD
Christina Gutta, MD and Raphaela Fontana, MD
Affiliation: University of South Carolina School of Medicine - Greenville, Greenville, SC.

Purpose: This study aimed to evaluate the performance of the IOC Sports Mental Health Assessment Tool-1 (SMHAT-1) in an NCAA collegiate athlete population for mental health screening by comparison to a psychiatric diagnostic interview.

Methods and Study Design: Collegiate athletes (n = 1640) underwent mental health screening including the SMHAT-1 components APSQ, GAD-7, PHQ-9, CAGE, AUDIT, ASSQ and BEDA during pre-participation evaluation. 212 athletes additionally underwent the Structured Clinical interview for DSM Diagnoses (SCID-5) components for generalized anxiety (GAD), major depressive disorder (MDD), anorexia nervosa and bulimia nervosa (BN).

Results: 41.8% of athletes were positive on at least one instrument: 2.6% GAD-7, 1.0% PHQ-9, 1.2% PHQ item 9, 1.1% CAGE, 0% AUDIT, 11.2% ASSQ, 34.1% BEDA. 9.7% of athletes were positive on APSQ triage. APSQ had a 18.8% sensitivity and 96.8% specificity for specific instrument screening. 81.2% of athletes with a positive follow up screen were missed on triage. APSQ detected a majority of positive GAD-7 (n = 42 69.0% detected), PHQ-9 (n = 16 81.3%), and PHQ item 9 (n = 19 57.9%) positives while missing the majority of ASSQ (n = 184 28.8%), CAGE (n = 18 27.8%) and BEDA positives (n = 560 18.8% detected). Two hundred twelve athletes underwent diagnostic interview. Only 1.4% met DSM criteria for at least one diagnosis (1 GAD, 3 MDD, 1 BN). 2/3 athletes were identified on APSQ triage, 0/1 athletes with GAD were identified on GAD-7, 1/3 with depression on the PHQ-9 and 0/3 on item 9, 1/1 athletes with BN were identified on BEDA. APSQ had 66.7% sensitivity and 90.3% specificity for DSM diagnoses.

Conclusions: APSQ had low sensitivity and positive predictive value for any positive screen (19%, 81%) or DSM diagnosis (67%, 1.3%). The prevalence of positive screening was low for GAD, MDD and substance use for a collegiate population and the low rate of DSM diagnoses potentially limits accuracy of predictive value calculation in this sample. The low prevalence raises concern for over detection by screens vs underreporting in interview.

Significance: It is unclear that current screening cutoffs are appropriate for the pre-participation setting or the collegiate athlete population. Identification or adjustment of screening tools for higher clinical utility is needed for effective care.

Topic: Concussion
Study Type: RCT

Sex Differences Throughout an Aerobic Exercise Intervention for Sport-Related Concussion

Submitting Author/Presenter: Sarah Robinson, DO

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Purpose: Aerobic exercise reduces the incidence of persisting symptoms and speeds recovery from sport-related concussion (SRC). We assessed sex differences in motivation, perceived competence, and prescription adherence through SRC recovery to evaluate the impact of these factors on exercise treatment.

Methods and Study Design: Athletes with SRC (n = 32, 66% male, 15.6 + 1.4 y) and controls (n = 28, 66% male, 16.0 + 1.6 y) were randomly assigned 2 weeks of aerobic exercise at high (5 days/wk, 30 min) or low volumes (3 days/wk, 20 min). Exercise intensity was based on exercise test results. Participants completed a Treatment Self-Regulated Questionnaire (TSRQ), a Perceived Competence Scale (PCS), and a clinical exam weekly.

Results: Concussed males and females did not differ in days to initial visit (4.29 + 2.85 vs. 6.18 + 2.21, $P = 0.22$) or days to recovery (16.9 + 10.74 vs. 20.22 + 15.44, $P = 0.53$). At the initial visit, concussed females achieved higher heart rates on exercise testing compared to males. (150.83 + 20.99 vs. 141.59 + 20.94) This same trend was found in healthy females compared to males (165.11 + 8.96 vs. 150.56 + 15.31). Therefore, females were prescribed higher target heart rates. There were no sex differences in exercise volume ($P = 0.64$). Healthy participants had higher exercise volumes than concussed patients ($P = 0.004$). Concussed females were less adherent to their prescriptions than healthy females (22% vs. 87%, $P = 0.020$) whereas concussed males were equally adherent vs. healthy males (50% vs. 47%, $P = 0.29$). No differences were found in any TSRQ motivation components. Concussed females reported lower PCS scores at the initial visit vs. healthy females ($P = 0.030$) whereas males had no differences in PCS scores.

Conclusions: Females were provided higher-intensity exercise prescriptions because they achieved higher heart rates during exercise testing. Nevertheless, females and males completed similar volumes of exercise. The data suggest it is unlikely that a lack of motivation or competence reduced concussed female adherence. Although not significant, females took an average of 3 more days to recover than males, which may be attributed partly to reduced adherence.

Significance: Aerobic exercise speeds recovery from SRC; however, concussed females did not meet exercise prescriptions as often as males. Future research should assess alternate prescriptions, such as longer duration lower intensity exercise, in females with SRC.

Topic: Epidemiology
Study Type: Case-Control

Risk Factors for Achilles Tendon Rupture After Quinolone Exposure

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Purpose: While it is well known that quinolone antibiotics are associated with tendon injuries, risk factors for Achilles

tendon rupture (ATR) after quinolone exposure are not well characterized. The purpose of this study was to identify risk factors associated with ATR after quinolone exposure.

Methods and Study Design: Using the Korean National Health Insurance Service database, a nested case-control study was conducted. Quinolone exposure was defined as prescription duration of 6 days or longer and searched up to 180 days prior to the date of ATR. Multiple logistic regression was performed with ATR as an outcome and independent variables including patient demographics and types of quinolone antibiotics.

Results: From 2009 to 2019, a total of 40,240 ATRs and 160,960 controls were included. The results of multiple logistic regression analysis demonstrated that the odds of ATR were higher in females (OR 1.23, 95% CI 1.19-1.28), obese patients (OR 2.20, 95% CI 2.09-2.32 for BMI 30~34.9 and OR 2.12, 95% CI 1.87-2.41 for BMI 35 or greater), patients with alcohol consumption (OR 1.11, 95% CI 1.06-1.16), patients with high physical activity level (OR 1.29, 95% CI 1.25-1.34), and patients exposed to levofloxacin (OR 1.28, 95% CI 1.13-1.44). The odds of ATR were lower in older adults than those of younger patients below 40 years old (OR 0.86, 95% CI 0.83-0.90), and there was a trend of decreasing odds with increasing age ($P < 0.001$ for trend). Other quinolones including ciprofloxacin, fleroxacin, lomefloxacin, norfloxacin, ofloxacin, and moxifloxacin were not associated with increased odds of ATR.

Conclusions: Our case-control study identified potential risk factors for developing ATR after quinolone exposure including female sex, obesity, alcohol consumption, high physical activity, and young age. Among various quinolone antibiotics, only levofloxacin was associated with increased odds of ATR.

Significance: Patients should be warned against potential ATR when prescribed with quinolone antibiotics. Levofloxacin should be judiciously prescribed, especially in patients who are young, female, obese, physically active, and/or consuming alcohol.

Topic: Cardiology
Study Type: Cohort

Echocardiographic Findings Associated With Rapid Weight Loss in Collegiate Wrestlers

Submitting Author/Presenter: Eric Twohey, MD

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Purpose: Rapid weight loss (RWL) is common in wrestling and known to impact health and performance. Much is known about chronic adaptions seen in the "Athlete's Heart Syndrome," but little is known about the effects of RWL. This study aimed to evaluate cardiac structure and function associated with RWL.

Methods and Study Design: Preseason baseline testing included height, weight, heart rate (HR), blood pressure (BP), and comprehensive transthoracic echocardiogram (TTE) with left and right ventricular global longitudinal strain. RWL was defined as the difference between maximum and minimum weight the week prior to the first tournament. Repeat (post

RWL) comprehensive TTE was performed the night before the first tournament.

Results: Fifteen wrestlers completed both pre- and post-testing. Three wrestlers did not undergo RWL due to their weight class (n = 2) or injury prohibiting them from competing (n = 1). Of the remaining twelve wrestlers, the mean RWL was 5.1 kg (range 2.9-10.6 kg). HR was significantly increased after RWL (baseline 63.6 vs. 71.2 BPM, $P = 0.005$) whereas both systolic (123.8 vs. 114.1 mmHg, $P = 0.04$) and diastolic (77.8 vs. 67 mmHg, $P = 0.003$) both decreased. On TTE, mitral inflow E wave on Pulse Wave Doppler (0.75 vs. 0.64, $P = 0.03$) and Mitral inflow E/A ratio (2.26 vs. 1.63, $P = 0.024$) were significantly reduced after RWL. There was a trend to a lower E/e' ratio ($P = 0.06$). Calculated LVEF (58.3% vs. 56.5%, $P = 0.042$) and GLS (−21.3% vs. −19.5%, $P = 0.012$) were also significantly reduced after RWL.

Conclusions: Increased HR and lower BP post-RWL likely reflect loss of body water and relative dehydration. There were statistically significant but very modest reductions in select measures of systolic and diastolic function on TTE. The small sample size of our study is a significant limitation.

Significance: RWL is associated with relative dehydration and modest decrease in measures of systolic and diastolic function on TTE. Future studies are warranted to clarify the clinical significance of these findings for athletic performance and wrestler safety.

Acknowledgements: Thank you to the Mayo Clinic Cardiology Department for helping fund this research project.

Topic: Musculoskeletal
Study Type: Cohort

The Efficacy of Ultrasound Versus Fluoroscopic Guided Knee Genicular Nerve Blocks

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Purpose: Genicular nerve blocks are performed prior to genicular radiofrequency ablation when treating knee osteoarthritis, but there have been no comparisons of imaging guidance efficacy. The aim of this study was to compare the efficacy of knee genicular nerve blocks using fluoroscopy versus ultrasound.

Methods and Study Design: This study employed a cohort design using historical data from 2020 to 2023 at 2 medical centers. Outcomes were percent pain improvement and the proportions of patients with 50% and 80% improvement in pain. Group comparisons were via t, Mann-Whitney U, and χ^2 tests (alpha = 0.05). Regression analyses were used to assess potential predictive factors (age, BMI, osteoarthritis severity) of outcomes.

Results: A total of 349 knees (M = 110, F = 239) in 252 patients (M = 77, F = 175) were included for study. Fluoroscopic guidance (FG) was used in N = 240 (M = 66, F = 174) and ultrasound guidance (UG) in N = 109 (M = 44, F = 65) knees. There were no differences in age (FG = 68.08 ± 12.1, UG = 68.89 ± 12.1, $P = 0.563$), BMI (FG = 34.6 ± 8.9, UG = 32.9 ± 9.2, $P = 0.166$), or Kellgren-Lawrence (KL) osteoarthritis severity (FG = 3.2 ± 0.8, UG = 3.1 ± 0.7, $P =$

0.068) between the groups. There were no statistically significant differences between the groups in % overall improvement (FG = 81.8 ± 26.22%, UG = 82.8 ± 20.41%, P = 0.211), or the proportion of cases with at least 50% improvement in pain (FG = 90.4%, UG = 92.7%, P = 0.201) or at least 80% improvement in pain (FG = 78.8%, UG = 79.8%, P = 0.820). Linear and logistic regression models were used to determine if patient characteristics (age, sex, BMI, KL severity) predicted percentage improvement in pain or membership in the groups with 50% or 80% improvement in pain; however, no patient factors loaded into any of the regression models (P > 0.05 in all cases).

Conclusions: Ultrasound guidance may be equivalent in efficacy to fluoroscopic guidance when performing diagnostic genicular nerve blocks. This relationship is not modified by patient clinical factors. The rate of genicular nerve block success, defined as 50% or greater reduction in pain, is high regardless of the imaging guidance used. Research regarding the efficacy of fluoroscopy versus ultrasound for genicular nerve ablations is warranted.

Significance: Given the higher costs of fluoroscopy, the use of ionizing radiation with fluoroscopy, the ease of point-of-care use of ultrasound, and equivalent efficacy, ultrasound should be considered for guidance when performing genicular nerve blocks.

Topic: Concussion
Study Type: Cohort

Abnormal Neurophysiology and P300 Event Related Potentials in MTBI Patients With Chronic Persistent Post-Concussion Symtpoms

Submitting Author/Presenter: David Tramutolo, DO
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Purpose: To identify symptoms and objective neurophysiological markers associated with late-stage persistent postconcussion symptoms (PPCS) persisting beyond one year.

Methods and Study Design: A retrospective cohort study of 31 patients with PPCS. Patients were screened for symptoms with the validated concussion profile (CP) screen and tested with oddball audio EEG protocol with P300 event related potential (ERP) voltage and latencies extracted. Patients were divided into 2 groups based on symptom duration (group A = < 3 months, group B = > 1 year). Data were compared using t-tests.

Results: Thirty-one patients who met study criteria were stratified into group A (n = 20, symptoms < 3 months at time of EEG) and group B (n = 11, symptoms > 1 year). Significant between group differences were noted for P300 ERP voltage (group A 15.21 microvolts, Group B 9.87 microvolts, P = 0.045) and latency (group A 282.8 mS, Group B 352.7 mS, P = 0.039). Further investigation into group A revealed 15% of the population had a p300 ERP abnormality (10% low voltage, 5% both voltage/latency abnormalities). Evaluation of group B revealed 82% with a p300 ERP abnormality (55% low voltage, 9% prolonged latency, 18% with both). Average CP screen scores (0 = none, 1 = mild, 2 = moderate, 3 = severe) were calculated and compared across groups. Statistical difference was noted for visual (A = 0.93, B = 1.57, P =

0.029) and cognitive (A = 0.91, B = 1.7, P = 0.007) symptoms, but not sleep, mood, vestibular, cervical or headache profiles.

Conclusions: Based on our pilot data investigating a group of chronic PPCS > 1 year, the initial data is suggestive that individuals with chronic late stage PPCS (symptoms > 1 year) show significantly more cognitive and visual symptoms and also demonstrate significantly more abnormal neurophysiology (w/r/t P300 ERPs) in comparison to others in earlier acute and subacute stages of concussion.

Significance: This study demonstrates significant differences in both clinical symptom profiles as well as neurophysiology in mTBI patients with late stage PPCS, a previously poorly studied group. Further investigation of this pilot study is warranted.

Topic: Epidemiology
Study Type: Cohort

The Effect of a Headgear Mandate on Eye, Face, and Head Injuries in High School Women's Lacrosse

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Purpose: In 2017, Florida began requiring headgear in women's high school lacrosse, but its efficacy for eye, face, and head injuries has not been compared to standard eyewear. The purpose of this study was to compare head injury rates between non-headgear mandating (NHM) and headgear mandating (HM) states.

Methods and Study Design: Athlete exposures (AEs) and eye, face, and head (areas other than eye and face) injuries were obtained via a national injury surveillance system (NATION). Injury incidence rates (IRs) were calculated as number of injuries divided by number of AEs, multiplied by 1000. 95% CIs were calculated for incidence rate ratios (IRR) using Poisson regression with 95% CI values excluding 1.00 being significant.

Results: Eye injuries were very low in both NHM [N = 3, 543755 AEs, IR = 0.006/1000 AEs (95% CI: 0.001-0.016)] and HM [N = 1, 147865 AEs, IR = 0.007/1000 AEs (95% CI: 0.000-0.038); IRR = 0.816 (95% CI: 0.085-7.844)]. There was no difference in the rate of injuries to the face in NHM [N = 65, IR 0.120/1000 AEs (95% CI: 0.092-0.152)] versus HM [N = 13, IR = 0.088/1000 AEs (95% CI: 0.047-0.150); IRR = 1.360 (95% CI: 0.750-2.467)]; however, NHM had a higher rate of injuries to the head [N = 51, IR = 0.094/1000 AEs (95% CI: 0.070-0.123)] versus to HM [N = 4, IR = 0.027/1000 AEs (95% CI: 0.007-0.069); IRR = 3.468 (95% CI: 1.253-9.594)]. When combining all eye, face, and head injuries, NHM [N = 119, IR = 0.219/1000 AEs (95% CI: 0.181-0.262)] had a higher injury rate versus HM [N = 18, IR = 0.122/1000 AEs (95% CI: 0.072-0.192); IRR = 1.798 (95% CI: 1.095-2.952)]. This difference was greatly magnified when only considering game-related AEs in NHM [N = 75, 159456 AEs, IR = 0.470/1000 AEs (95% CI: 0.370-0.590)] versus HM [N = 8, 45396 AEs, IR = 0.176/1000 AEs (95% CI: 0.076-0.347); IRR = 2.669 (95% CI: 1.288-5.532)].

Conclusions: NHM play (for which prior data has shown ~99% of athletes use standard protective cage eyewear/

goggles) and HM play are associated with very low rates of eye injuries. NHM play is associated with a higher risk of all injuries to the head area, which is primarily driven by injuries outside of the eyes and face. This risk is 167% greater during game play, despite prior data showing HM play is associated with twice the rate of impacts to the head.

Significance: Despite typically using an alternative eye protection design, headgear appears to be similar to eyewear regarding eye injury rates while protecting against other head injuries. Headgear should be strongly considered for use in women's lacrosse.

Topic: Running
Study Type: Cohort

Predicting Injury Using Strava Data of Runners Training for the New York City Marathon

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Purpose: To address the high incidence of injuries while training for a marathon and leverage abundant training data being collected by runners, our study aimed to create a model predicting first running injury during training for the New York City Marathon by combining health data with Strava training data.

Methods and Study Design: Prospective trial of adult marathon registrants. A baseline survey captured demographics, experience, and injury history. Weekly health surveys and Strava data were tracked during the 16 weeks before the race. A machine learning algorithm that allows for non-linear relationships (generalized additive models) was trained on a random 80% and tested on the remaining 20% of runners.

Results: There were 643 runners who participated and provided Strava data; mean age was 43 (standard deviation 12) and 343 (53%) were female. Injuries were reported during training by 326 (51%). The model performance (area under the receiver operating characteristic curve) was 0.79 for the training set and 0.71 for the holdout test set. Top predictors were prior history of running injury (mean absolute score 0.08), 7:28-day acute: chronic workload ratio (ACWR) (0.06), and fatigue in the past week (0.05). A non-linear relationship was observed for ACWR: risk for injury was flat for lower values of ACWR, increased abruptly/nonlinearly at ACWR = 1.35 (odds ratio = 1.2 associated with crossing the threshold), was flat again until ACWR = 2.0, where another similarly-sized nonlinear increase was observed (albeit not statistically significant), and flat for higher ACWR values.

Conclusions: Fairly accurate injury prediction was achieved using machine learning. Modifiable risk factors like training load and fatigue were identified. This insight can guide future injury prevention programs for marathon runners, emphasizing dynamic adjustments in training practices.

Significance: Our study introduces a novel approach, utilizing Strava data and machine learning, to predict running injuries. The identified modifiable risk factors offer actionable insights, advancing personalized injury prevention strategies.

Topic: COVID
Study Type: Cohort

The Relationship Between COVID-19 and Neurocognitive Scores After Return to Play

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Purpose: Studies have shown that even mild cases of COVID-19 are associated with neurocognitive deficits lasting months after acute illness. This study evaluates whether collegiate athletes have lower Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) scores after COVID-19.

Methods and Study Design: Historical data was used to match athletes with COVID-19 to controls by sex, sport, and age. Athletes were followed for their next ImPACT test and categorized as occurring 0 to 180, 181 to 365, and 365+ days after return to play. Scores were analyzed with repeated-measures (Time, COVID-19 status) ANOVA to assess for differences across all 4 ImPACT domains within the 3 categories (alpha = 0.05).

Results: Division 1 NCAA athletes (N = 356; 49.4% Male; 50.6% Female) across 17 sports at a single institution were included. The mean time between COVID-19 diagnosis and the following ImPACT test was 315.8 days (SD = 179.8). A statistically significant interaction effect was observed for the 0 to 180 days category in Visual Memory score (N = 116, 115.8 ± 36.7 days; Mean Difference $\pm$ Standard Deviation: COVID-19 = 4.07 ± 11.28 vs Controls = -0.92 ± 10.40; F = 5.662, $P = 0.019$; partial $\eta^2 = 0.047$) as well as for the 365+ days category in Visual Memory score (N = 156, 494.7 ± 76.9 days; COVID-19 = 4.24 ± 11.28 vs Controls = 0.60 ± 10.40; F = 4.413, $P = 0.037$; partial $\eta^2 = 0.028$), with minimally improved scores in athletes with COVID-19 over time compared to control athletes. No statistically significant interaction effects were observed for the 181 to 365 days category ($P > 0.05$ for all 4 domains). An exploratory analysis was performed by athlete sex across all 3 categories, but no statistically significant interaction effects were observed ($P > 0.05$ for all 4 domains).

Conclusions: No substantial effect of COVID-19 infection on neurocognitive function assessed by ImPACT was observed; however, COVID-19 can result in myriad phenotypes, some which may not demonstrate decrements in neurocognition. Alternatively, ImPACT may not be sensitive to changes in performance due to COVID-19. Investigation of phenotypes with greater neurocognitive manifestations using repeated testing over smaller time increments may still be indicated.

Significance: These results suggest it may be unnecessary to re-baseline collegiate athletes after COVID-19 infection or to take recent COVID-19 status into account when making judgements on return to play after concussion on the basis of neurocognitive scores.

Topic: NCAA
Study Type: Survey

The Impact of Name, Image, and Likeness (NIL) Policy on Collegiate Athlete Mental Health

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Purpose: The Name, Image, and Likeness (NIL) policy provided new opportunities for student-athletes to monetize their athletic abilities. This study investigated the impact of NIL on collegiate athlete mental health, contributing to a better understanding of the potential consequences of this policy.

Methods and Study Design: In this cross-sectional study, collegiate athletes from a single institution participated in an IRB-approved anonymous survey. The survey included the Sport Mental Health Assessment Tool 1 (SMHAT-1), a standardized tool to identify athletes at risk for mental health issues, as well as questions on the perceived impact of NIL on mental wellbeing.

Results: Two hundred nine collegiate student-athletes completed the survey between September and November 2023. The survey included 135 female athletes, 71 male athletes, and 3 non-binary athletes from 14 different sports. A total of 28 respondents reported current engagement with NIL deals, with 19 athletes earning $0 to 500, 8 athletes earning $500 to 1,000, 6 athletes earning $1,000 to $10,000, and 3 athletes earning above $10,000. A SMHAT-1 score greater than or equal to 17 is a positive screen for potential mental health issues. The average SMHAT-1 score of respondents engaged in NIL deals was 16.4, while the average score of those not engaged in NIL deals was 15.8. A *t*-test to compare the means of the 2 groups yielded a *P*-value of 0.59. 57% of those engaged in NIL deals felt NIL had a positive impact on their mental health, compared to 24% of those not engaged. 86% and 75% of those engaged in NIL deals had high confidence and body satisfaction scores, compared to those not engaged (73% and 65%).

Conclusions: Average SMHAT-1 scores were not significantly different for those engaged in NIL deals compared to those who were not. A greater proportion of those engaged in NIL deals stated that the NIL policy had a positive impact on their mental health compared to those who were not engaged in NIL deals. A greater proportion of those engaged in NIL deals had higher confidence and body satisfaction scores compared to those not engaged in NIL deals.

Significance: The results suggest that athletes engaged in NIL deals do not have significantly better or worse mental health than non-engaged athletes. The majority of athletes engaged in NIL feel that the policy has positive mental health impacts.

Topic: Concussion
Study Type: Cohort

Assessment of Stimulated Blink Reflex and Symptoms Over Time in Collegiate Athletes With Sports-Related Concussion

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Purpose: Recovery times for collegiate athletes with sport-related concussion (SRC) range from 2 to 4 weeks. The stimulated blink reflex is abnormal after SRC. This study assessed the blink reflex daily from initial assessment (within 2 days of injury) to recovery and compared it with symptom recovery.

Methods and Study Design: Prospective cohort. Blink reflex (EyeStat) and Post-Concussion Symptom Scale (max = 126) were assessed daily from injury to recovery. Blink reflex parameters: time to ipsilateral blink (latency), contralateral blink (differential latency), initial velocity, time to open, time to close, number of oscillations, and distance traveled (excursion). Associations over time were assessed using regression.

Results: Forty-one SRC (from 36 unique athletes, 20.46 ± 1.50 y/o, 79.5% male, 0.95 ± 1.2 days since injury) are included in analysis. Mean symptom severity at initial assessment was 25.00 ± 17.3 and mean time to symptom resolution was 10.87 ± 7.3 days. No significant correlation over time (ie, *P*-value of interaction term of blink reflex parameter with days since injury) was observed between daily symptom severity and differential latency ($P = 0.097$), initial velocity ($P = 0.150$), time to open ($P = 0.506$) and number of oscillations ($P = 0.228$). However, a significant association was found for latency ($P = 0.016$), time to close ($P = 0.017$) and excursion ($P = 0.012$). In all 3 of these regression models, symptom severity significantly decreased over time ($P = 0.013$, 0.017 and 0.013, respectively) and correlated with individual blink reflex parameters throughout the recovery period ($P = 0.002$, <0.001 and <0.001, respectively).

Conclusions: Certain stimulated blink reflex parameters (latency, time to close and excursions) have a significant association with daily symptom reporting over time, meaning that they are abnormal when athletes report a high number of symptoms and return to baseline when athletes are asymptomatic.

Significance: Identifying patterns on how the blink reflex changes throughout recovery and identifying those that are associated with symptom recovery can help develop algorithms that can use change in blink reflex parameters to predict symptom recovery.

Topic: Pediatrics
Study Type: Cohort

Young Athlete Injury Outcome Study: Longitudinal Health-Related Quality of Life (HRQoL) Analysis

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Purpose: Long-term effects of sport-related injury (SRI) on HRQoL in young athletes are unknown. We previously reported short-term HRQoL deficits following injury. This study's purpose is to compare HRQoL between injured young athletes and normative data for healthy youth (NDHY) for 2 years post-injury.

Methods and Study Design: Multi-site clinical cohort study of youth ages 8 to 18 who presented to clinic with SRI. Baseline sport and injury history were collected. HRQoL was measured at 1, 12, and 24 months via the PROMIS Pediatric-25 v2.0. Six HRQoL domains were analyzed by injury type (acute, overuse, concussion) with a mixed model for repeated measures. Scores greater than 0.5 SD from the reference mean were significant.

Results: Of 720 patients enrolled, 357 patients completed baseline surveys (36% male, 64% female; average age: 14.4). At 1 month post-injury there were 119 (33.3%) acute injuries, 42 (11.8%) concussions, and 196 (54.9%) overuse injuries. 336 (94.2%) were athletes and 21 (5.8%) were non-athletes. Cohort retention was 65% and 35% at 12 and 24 months, respectively. Patients with overuse and serious overuse injury showed worse mobility at 1 month post-injury compared to NDHY (Mean [95% CI] = 44.4 [43.1, 45.6]). However, these differences resolved at 12 and 24 months post-injury such that there was no significant difference compared to NDHY. Additionally, patients who were older, female, or quit sport showed worse mobility than NDHY at 1 month post-injury. However, these differences resolved at 12 and 24 months post-injury such that there was no significant difference compared to NDHY.

Conclusions: We believe this is the first multi-site longitudinal clinical cohort study of ages 8 to 18 evaluating long-term HRQoL following injury. Mobility is worse compared to NDHY 1 month post-injury in young athletes who are older, female, quit sport, or sustain overuse injury. However, mobility recovers at 12 and 24 months. -There is otherwise no difference between injured young athletes and NDHY in any HRQoL domain at 1, 12 and 24 months post-injury.

Significance: While some short-term HRQoL deficits exist, patients and their families may find reassurance in learning that young athletes may recover from short-term HRQoL deficits and not have long-term HRQoL deficits following all injury types and attrition.

Topic: COVID
Study Type: Cohort

Brain Neurophysiology With P300 Evoked Response Potentials in Long COVID vs Persistent Post Concussive Syndrome Patients

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Purpose: To evaluate brain neurophysiology utilizing quantitative electroencephalography (qEEG) P300 evoked response potentials (ERP) of patients with cognitive (cog) fatigue from Long COVID compared with persistent post concussive syndrome (PPCS) patients undergoing similar neurorehabilitative treatments.

Methods and Study Design: Retrospective longitudinal review of 24 Long COVID and PPCS patients from 2019 to 2023 at 3 visits who underwent a multimodal concussive treatment plan. Brain neurophysiology was evaluated with qEEG technology utilizing an audio oddball P300 protocol. P300 ERP latency, voltage, and coherence were measured as well as reported symptoms in the Concussion Clinical Profiles Screening Tool (CP screen).

Results: The Long COVID cohort showed improvement in qEEG values, and had statistically significant latency (292.8 ms to 261.67 ms) ($P = 0.025$), avg central parietal voltage (5.21 uV to 7.31 uV) ($P = 0.04$), and reduced coherence (6.52-3.42) ($P = 0.03$) when comparing first and last visit. The PPCS cohort also showed improvement in qEEG values, and had statistically significant voltage (7.78 uV to 11.01 uV) ($P = 0.01$) and avg central parietal voltage (5.27 uV to 7.21 uV) ($P = 0.05$) when comparing first and last visit. These improvements correlated with clinical improvements over time in total symptom score using the CP screen, but more specifically the cognitive fatigue profile from 1.78/3 to 1.58/3 in Long COVID cohort and from 1.78/3 to 1.09/3 in the PPCS cohort at first and last visit. Multidisciplinary treatments in these cohorts included active rehab protocol, physical therapy, occupational therapy, and cognitive behavioral therapy throughout the duration of their care of at least 6 to 28 months (avg 10.5 months).

Conclusions: P300 ERPs in Long COVID and PPCS patients demonstrated abnormal results but showed improvement overtime correlating with clinical symptoms after multidisciplinary neuro rehabilitative treatment interventions. Overall, both cohorts displayed similar trends in their condition progression, with improvements in P300 voltage and reduction of abnormal coherence as clinical symptoms improved.

Significance: P300 ERPs are routinely used to assess brain neurophysiology in patients with chronic functional neurologic deficits, like in PPCS. qEEG may prove to be a promising objective measure of cognitive symptom burden in patients with Long COVID.

Topic: Other
Study Type: Other

The Psychological Impact of Medically Forced Exit from Sport and Athlete Perception of Available Support

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Purpose: Research on the patterns of psychological response for athletes no longer able to compete due to injury or other health conditions is limited. This study investigates the psychological impact of athletes experiencing medical

retirement and the related mental health risks and satisfaction of support.

Methods and Study Design: Online survey consisting of closed-ended or Likert questions completed by 104 medically retired athletes consisting of 31 items divided into 6 sections: the context surrounding their medical exit; psychological impact of medical retirement; risk of depression, suicide, and drugs/alcohol abuse; coping strategies; available support and satisfaction levels of support offered.

Results: Completed surveys were analyzed via descriptive and frequency statistics for all questions. The most common reasons for medical disqualification were (1) one single devastating injury (25%), (2) repeat injuries (22.1%), (3) multiple concussions (21.2%). Most participants reported their medical exit was "mostly" or "completely" unexpected (70.2%). Regarding their involvement in the decision to discontinue competition for medical reasons, 42.3% of survey respondents reported they were "not at all" involved, while 31.7% were "partially involved," and 25% were "fully involved" in the decision. 75% of participants often downplayed their struggle when people asked how they were doing, 90% experienced identity loss, 75% reported depression, 31% reported suicidal ideation, and 76% felt like a part of them had died. 20% reported utilizing alcohol and/or drugs as a coping mechanism. 48% of participants with an associated athletic trainer wished their AT was more supportive.

Conclusions: Medical exit from sport caused by career-ending injury, health condition, or repeat concussions can have significant and long-lasting psychological impact. Athletes who experience medical retirement are at significant risk for mental health concerns. Thus, medical retirement from sport should be considered a potential life crisis which warrants specialized after-care plans and resources as a means to provide much needed support.

Significance: There is no nationally recognized standard of care for medically retired athletes. This is the largest study known which seeks to understand the support that medical disqualified athletes receive and the support they feel would be most helpful.

Acknowledgements: T.L. Neal, C. Pinalto, M. Stanek, K. Bullard, H. Labrador.

Topic: Concussion
Study Type: Cohort

Autonomic Pupillary Light Reflex Measures Post Exertional Testing in MTBI Patients With Exercise Intolerance

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Purpose: Investigate the changes in autonomic pupillary light reflex (PLR) markers in mTBI patients with exercise intolerance (EI) following standardized exertional testing.

Methods and Study Design: Retrospective review of 200 trials of exertional testing in 200 mTBI patients, ages 6 to 77, in 2021 to 2023. 100 had exercise intolerance (EI) and 100 had exercise tolerance (ET). Exertional testing was completed with pre- and post-autonomic PLR testing. A concussion

specialist determined ET and EI by evaluating for the onset of signs, symptoms, and/or cardiovagal dysautonomia.

Results: Autonomic PLR with marker max constriction velocity (MCV) was significantly increased in the EI group, post-exertional testing, by an average change of 1.596 mm/sec, compared to those in the ET group who experienced a significant decrease, exhibiting an average change of 1.846 mm/sec ($P = 0.000147$). Other autonomic PLR markers including amplitude ($P = 0.557$), latency ($P = 0.276$), maximum diameter ($P = 0.393$), minimum diameter ($P = 0.366$), release amplitude ($P = 0.0868$), average constriction speed ($P = 0.364$), constriction time ($P = 0.966$), average dilation velocity ($P = 0.323$), and average diameter ($P = 0.171$), which all showed no statistically significant difference.

Conclusions: Subclinical autonomic PLR marker MCV may be utilized to identify autonomic etiologies for EI in mTBI. Furthermore, PLR testing can prove to be a subclinical measure that can aid exercise and sport clearance decisions with mTBI. Such trends require further testing with a larger sample size to generate definitive conclusions.

Significance: Exertional rehab at the appropriate dose plays a central role in concussion management. PLR may serve as a valuable tool in assessing autonomic function with exertional testing and helping identify clinical or subclinical EI in concussion patients.

Topic: NCAA
Study Type: Cohort

Achilles Tendon Ultrasound Characteristics in NCAA Division I Gymnasts

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Purpose: The purpose of this study was to assess the ultrasonographic appearance of Achilles tendons in NCAA Division 1 gymnasts upon completion of the competitive season along with a survey assessment for Achilles tendon pain/injury.

Methods and Study Design: This IRB-approved cross-sectional study enrolled subjects from a NCAA Division 1 women's gymnastics team at end of the 2021 to 2022 season. Gymnasts completed 2 surveys: (1) A demographics and gymnastics background survey and (2) VISA-A (reliable and valid survey for Achilles tendinopathy). Achilles tendon ultrasounds were done by a RMSK certified physician. Descriptive statistics were used.

Results: Eighteen of twenty-one (86 percent) rostered gymnasts agreed to participate, completed the surveys, and underwent bilateral Achilles tendon ultrasounds. Three gymnasts were not available on the date of data collection. Thirty-five Achilles tendons were included, with one excluded for prior repair. Although only 2 gymnasts (11.1 percent) complained of current Achilles tendon pain (3 tendons), 8 gymnasts scored less than 90 on the VISA-A questionnaire (asymptomatic controls mean VISA-A score is generally 96-

100). On ultrasound imaging, 97.1 percent (34/35) of the Achilles tendons were assessed as normal. One single tendon was mildly hypoechoic.

Conclusions: This study demonstrates that despite nearly half of the gymnasts endorsing symptoms, based on their VISA-A scores, which may be consistent with Achilles tendinopathy, the majority of these athletes' Achilles tendons appeared normal on ultrasound examination performed at the end of the competitive seasons by a sports medicine physician certified in musculoskeletal ultrasonography.

Significance: Achilles tendon injury risk is ten-fold higher in Division 1 collegiate gymnasts than any other NCAA sport. This is the first study to assess Achilles tendon ultrasonographic appearance along with symptom assessment in collegiate gymnasts.

Acknowledgements: The authors would like to thank to members of the University of Minnesota Women's Gymnastics team, Jenny Hanson (Head Coach) and Shanice Cheatham (ATC) for their support and participation in this study.

Topic: Running
Study Type: RCT

Impact of a Supplemental Strength Program on Running Related Injuries in Adolescent Marathon Runners

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Affiliation: University of Alabama at Birmingham (UAB), Birmingham, Alabama.

Purpose: Despite the popularity of adolescent distance running, there is little data on the role of adolescent strength training in injury prevention. Our study sought to determine if incorporating a weekly strength training program would reduce injury rates in adolescents training for a marathon.

Methods and Study Design: Adolescents participating in the 26 week Students Run LA program were recruited. The intervention group were given 8 exercises targeting quadricep, gluteal, hamstring, calf, core, ankle, and intrinsic foot muscles to complete twice a week. The control group followed individual coaching instructions. Mileage, injury data, and strength training data were completed weekly by coaches.

Results: Three hundred seventy-nine students (50% F, avg 15 yo) were assigned to the strength training group (STG) compared to 229 (51% F, avg 15 yo) in the control group (CG). The STG ran 16.62 miles per week on average over 26 weeks compared to 13.38 miles per week in the CG ($P = 0.001$). The STG averaged 2.17 miles difference per week over 26 weeks compared to 1.87 miles per week in the CG ($P = 0.53$). 70% of the STG completed their surveys each week on average compared to 86% in the CG. On average, 56% of the STG completed strength training each week with 63% completing one session over 13+ weeks. On average, 38% of the CG completed a non-specific strength training regimen each week with all but one student completing less than one session over 13 weeks. Those in the STG had a statistically significant lower percentage of individuals reporting an injury compared to the CG (21% vs 30%, $P = 0.01$). However, those

reporting an injury in the STG were more likely to report more than one injury in the season compared to the CG (54% vs 25%, $P = 0.0002$).

Conclusions: Our results support the incorporation of consistent strength training into a distance running program. Further studies are needed to assess potential variations in injury patterns between groups. Limitations include coach reported injuries, inconsistent survey reporting as well as some members of the control group performing strength exercises. However, the STG performed a specific program more consistently over the training.

Significance: The results of this project suggest that the incorporation of specific strength training programs for adolescent distance runners can lead to injury reduction and expands the currently limited literature on this topic.

Topic: Training
Study Type: RCT

Spatial Awareness Training Can Reduce Lower Extremity Joint Loads in Recreational Basketball Players

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Purpose: The purpose of this study was to determine the effects of 8-weeks of spatial awareness training on recreational basketball players' ankle and knee joint forces while they executed common basketball skills.

Methods and Study Design: Healthy, recreational basketball players were assessed with 3-D motion capture as they performed reactive defensive slides and unplanned jump landings after catching a rebound. Players completed dodging, personal space maintenance, and peripheral perception drills 3×20 minutes/week for 8 weeks and were then re-tested. Lower extremity kinetics were calculated and compared pre-post training.

Results: Twenty basketball players (19.5 ± 2.1 years, 1.87 ± 0.08 m, 79.6 ± 4.8 kg, 80% male) completed the spatial awareness training. Peak knee joint resultant force during unplanned jump landing was significantly lower post training (86 ± 10 N/kg vs 68 ± 9 N/kg, $t = 5.98$, $P < 0.01$). Center of Mass (COM) vertical displacement during rebounding trended greater post training (0.41 ± 0.14 m vs 0.46 ± 0.12 m, $t = 1.21$, $P = $ n.s.). Peak ankle joint lateral shear force during defensive slides was significantly lower post training (22 ± 3 N/kg vs 26 ± 2 N/kg, $t = 4.96$, $P < 0.01$). COM lateral velocity during defensive slides was significantly greater post training (3.4 ± 0.6 m/s vs 3.8 ± 0.5 m/s, $t = 2.29$, $P < 0.05$).

Conclusions: Recreational basketball players displayed reduced ankle lateral shear and knee joint resultant forces when performing reactive and unplanned basketball skills following 8-weeks of spatial awareness training. These reductions in joint forces were accompanied by neutral or positive changes in performance kinematics. Spatial awareness training appears to be effective at reducing game-time joint loads without diminishing performance.

Significance: Since excess joint force is a major biomechanical mechanism of non-contact injury, visuospatial training appears promising for injury prevention.

Acknowledgements: We would like to thank our participants for volunteering their valuable time with us.

Topic: Eating Disorders
Study Type: Cohort

SCOFF Outperforms EAT-26 and BEDA-Q Relative to Diagnostic Interview in Collegiate Athletes

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Purpose: This study aimed to evaluate the performance of multiple screening tools for eating disorders in NCAA collegiate athletes compared to a standardized DSM diagnostic interview for anorexia nervosa (AN) and bulimia nervosa (BN).

Methods and Study Design: Collegiate athletes (n = 1731) underwent mental health screening including SCOFF and BEDA-Q during pre-participation evaluation. Sixty-seven athletes completed EAT-26 screening and 212 athletes a Structured Clinical interview for DSM Diagnoses (SCID-5). Sixty-seven athletes who screened positive on SMHAT-1 component APSQ during PPEadditionally completed the EAT-26 questionnaire.

Results: 0.9% of athletes were identified as meeting criteria for a DSM diagnosis of an eating disorder on SCID-5. 3.9% of total athletes screened positive on SCOFF, 22% on EAT-26, and 47% on BEDA-Q. Of the screening tests, onlySCOFF showed a small correlation (0.26, $P/=9$). Using established cutoffs results in decreased sensitivity and specificity for BEDA (0.5, 0.62; $>/=4$) and EAT26 (0, 0.45, $>/=20$).

Conclusions: The questionnaires examined show widely variable prevalence and clinical utility in comparison to diagnostic interview. SCOFF has the highest clinical utility in this cohort showing a positive correlation with SCID diagnosis and the highest sensitivity, specificity, and AUC. If use of EAT-26 or BEDA-Q are desired consideration of alternative cut points for positive screening should be considered.

Significance: Although the low prevalence of DSM diagnosis for eating disorders in collegiate athletes may limit the interpretation of these results, performance in this cohort recommends screening with the SCOFF tool rather than BEDA-Q or EAT-26 questionnaires.

Topic: Ultrasound
Study Type: Other

An In-Plane Technique for Ultrasound-Guided Proximal Tibiofibular Joint Injection: A Cadaveric Investigation

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Purpose: Proximal tibiofibular joint (PTFJ) pathology is a rare cause of lateral knee pain, and ultrasound-guided (USG) injections can aid diagnosis and treatment. The purpose of this

study was to describe and validate an USG PTFJ injection using an in-plane technique in a cadaveric model.

Methods and Study Design: One experienced operator performed 10 USG PTFJ injections using an in-plane, cephalad/posterior to caudad/anterior technique using colored latex. A clinical anatomist performed dissections of 8 specimens, and 2 specimens were reserved for frozen cross-sections. Confidence of intra-articular flow, technical difficulty, latex location within the PTFJ, and iatrogenic injury data were collected.

Results: Ten fresh-frozen cadaveric knee specimens (4 female, 6 male), aged 86 to 96 years (mean 91.7 years), with body mass indices of 21.4 to 29.2 (mean 24.6 kg/m^2), were used in this investigation. The operator rated high confidence of intra-articular flow for all 10 injections. Eight injections (80%) were graded with no technical difficulty and 2 injections (20%) were graded with moderate difficulty. The average injected dye volume was 0.75 mL. Dissection revealed 10 out of 10 injections (100%) were accurately injected into the PTFJ, with one injection (12%) having some periarticular overflow. No correlation between technique difficulty and accuracy was observed ($P = 0.5$). No neurovascular injuries were observed.

Conclusions: In this cadaveric model study, an USG PTFJ injection using an in-plane, cephalad/posterior to caudad/anterior technique was highly accurate, safe, and technically feasible.

Significance: This is the first study to validate an USG PTFJ injection performed with an in-plane technique. Clinicians may consider using this in-plane method as an alternative to the previously described out-of-plane technique for USG PTFJ injection.

Acknowledgements: Kurian Punnose, MBBS, MD.

Topic: Pediatrics
Study Type: Cohort

ACL Injury Risk: The Development of Adolescent Jump Landing Biomechanics Based on Sex, Pubertal Stage, and Leg Strength

Submitting Author/Presenter: Lily Justine, BS

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Purpose: Sex divergence in ACL injury risk occurs during puberty and is associated with concomitant divergence in biomechanics. Strength development in puberty tends to be less and delayed in females compared to males, but the relationship between strength development and biomechanics is not currently known.

Methods and Study Design: Middle school children were assessed using the Puberty and Maturation Observational Scale, hand-held dynamometry of the knee extensors/flexors and hip extensors/abductors, and the Landing Error Scoring System (LESS). ANOVAs were used for group comparisons by sex and pubertal status and linear regression to assess the relationship between LESS, strength, sex, and pubertal status (alpha = 0.05).

Results: N = 109 subjects (Male = 55; Female = 54) were included. While strength was similar by sex in pre/early pubertal males (N = 41) and females (N = 12, $P > 0.05$), there was significantly greater knee extension (KE: M = 6.53 ± 1.82 v. F = 5.33 ± 1.69N*m/kg, $P = 0.030$), knee flexion (KF:

M = 4.35 ± 1.28 v. F = 3.26 ± 0.933N*m/kg, $P = 0.001$) and hip extension (HE: M = 5.33 ± 1.29, F = 4.13 ± 1.23 N*m/kg, $P = 0.003$) but not hip abduction (HA: M = 5.26 ± 1.35, F = 4.45 ± 1.34 N*m/kg, $P = 0.058$) strength in late/post-pubertal males (N = 14) compared to females (N = 39). Similarly, no differences were observed in pre/early-pubertal LESS grades (M = 4.80 ± 1.58 v. F = 5.08 ± 1.16, $P = 0.562$) while late/post-pubertal males had lower LESS grades than females (M = 3.79 ± 0.883 v. F = 5.13 ± 1.42, $P = 0.002$). LESS scores improved between the pre/early pubertal and late/post pubertal stages in males ($P = 0.015$) but not in females ($P = 0.792$). HA was a strong predictor of LESS in late/post-pubertal males ($R^2 = 0.76$, $F_{(1,12)} = 38.03$, $P = 0.001$). In contrast, KE was a weak predictor of LESS in late/post-pubertal females ($R^2 = 0.158$, $F_{(1,37)} = 6.97$, $P = 0.012$).

Conclusions: This is the first study to link strength development to the onset of sex-based biomechanics diversion in maturation. Male adolescents exhibit superior lower extremity strength and jump landing biomechanics compared to females in the late/post-pubertal stages. Males employed a hip-dominant strategy with HA predicting 76% of the variance in LESS, while females tended to use quadriceps-dominant strategy that is weakly predictive of LESS.

Significance: Hip strengthening during early pubertal stages continuing through maturation may be a strategy to prevent the development of biomechanical strategies observed in females, potentially reducing ACL injury risk. Longitudinal studies are needed.

Topic: Concussion
Study Type: Case-Control

Outcomes Following Youth Sport-Related Concussion During the School Year vs. Summer Break

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Purpose: Cognitive loading after youth concussion may increase symptom burden and prolong recovery. However, summer breaks offer decreased cognitive loads despite continued sport exposure. This study compared concussion reporting and outcomes between in-school (School) and out-of-school (Summer) periods.

Methods and Study Design: Prospectively collected ConTex registry data were reviewed for full-time students aged 6 to 18 with sport-related concussions (SRC). Injury details, concussion history, symptom and return to sport outcomes, ImPACT, BESS, and King-Devick scores were assessed. Summer injuries ranged May 24th to August 15th based on the average Texas school calendar. Chi-Square and Mann-Whitney tests were run with A = 0.05.

Results: Athletes (age 14.1 ± 2.2 years; 52.9% male) were similar between the School (n = 1753) and Summer (n = 110) groups in demographics, injury characteristics, and time to presentation. No differences in presence of learning disabilities (13.6% Summer; 19.2% School; $P = 0.150$), psychological disorders (15.5% Summer; 12.2% School; $P = 0.321$), or ImPACT symptom scores at presentation were observed. Overall, athletes were primarily injured playing football (29.2%), soccer (22.8%), or basketball (12.7%). The Summer group more often reported their injuries immediately (76.6% Summer; 66.1% School; $P = 0.024$) and had slower King-Devick test times ($P = 0.003$). Recovery outcomes were similar between groups. No differences were observed in persistent post-concussion symptoms (>30 days; $P = 0.250$) or return to sport at 3 months ($P = 0.284$).

Conclusions: Symptom recovery times, persistent post-concussion symptoms, and return to sport rates did not differ between the School and Summer groups. Though immediate injury reporting was slightly higher in the Summer group, time to clinic after injury, symptom severity measures, and demographics were similar. As such, overall symptom resolution was found to be similar between those injured during the school year and those injured during summer break.

Significance: Cognitive loading during school does not negatively impact recovery time after SRC, which may minimize providers' concerns regarding concussions sustained during periods of academic involvement compared to periods of academic rest.

Topic: Musculoskeletal
Study Type: RCT

Comparison of Pain With Ultrasound-Guided Intraarticular Hip Injections With and Without Prior Local Anesthesia

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Purpose: The purpose of this randomized controlled trial is to compare pain levels of intraarticular hip steroid injections performed with and without prior local anesthesia injection.

Methods and Study Design: Subjects undergoing a first-time ultrasound-guided unilateral intraarticular hip steroid injection were randomized into 1 of 2 groups: hip injection with prior subcutaneous local anesthesia with 2 mL of lidocaine 1% (With LA) or hip injection without prior local anesthesia (Without LA). The primary outcome measure was intraarticular hip injection visual analog scale (VAS) pain score (0-100).

Results: Using a power of 80%, an alpha of 0.05, and a standard deviation (SD) of 18, we calculated a sample size of at least 18 subjects per group (36 total) to detect a 17-point minimal clinically important difference in VAS. 41 subjects were included in the study: 18 randomized to the Without LA group and 23 to the With LA group. There was no significant difference in baseline (pre-procedure) VAS scores between the Without LA (mean ± SD = 39.2 ± 27.2) and With LA (41.2 ± 24.0) groups ($P = 0.864$). Mean ± SD VAS score for the local anesthesia injection in the With LA group was 20.4 ± 16.1. There was no significant difference in VAS scores for the

intraarticular hip injection between the Without LA (48.5 ± 27.7) and With LA (39.5 ± 25.7) groups ($P = 0.232$).

Conclusions: Subcutaneous injection of lidocaine prior to an intraarticular hip injection did not significantly decrease the pain level of the intraarticular hip injection. Providers may perform intraarticular hip injections with a 22-gauge 3.5-inch spinal needle without the need for an extra local anesthesia injection.

Significance: These study findings can streamline the patient experience with intraarticular hip injections. Reducing the use of excess anesthetics and shortening providers' preparation and procedure time can also improve cost- and time-efficiency in clinic.

Topic: Epidemiology
Study Type: Cohort

The Effect of Playing Surface on ACL Tears and Other Acute Lower Extremity Injury Risk in High School Womens Lacrosse

Submitting Author/Presenter: Nicole Leonard, MD

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Affiliation: University of California at Davis.

Purpose: The literature is inconsistent regarding the risk of injury by surface type; however, studies have primarily targeted high-level male athletes across few sports. The purpose of this study was to examine the impact of playing surface on lower extremity injury rates in womens' high school lacrosse.

Methods and Study Design: Athlete exposures (AEs), acute time-loss injuries, and surface type (field turf, grass) were obtained via a national injury surveillance system (NATION).

Injury incidence rates (IRs) were calculated as the number of injuries divided by the number of AEs, multiplied by 1000. 95% CIs were calculated for incidence rate ratios (IRR) using Poisson regression with values excluding 1.00 being significant.

Results: Acute time-loss lower extremity injuries (fractures, ligament sprains, muscle strains, tendon tears) on field turf [N = 593, 411527 AEs, 1.441/1000 AEs (95% CI: 1.330-1.562)] were significantly, albeit slightly, more common compared to natural grass [N = 303, 245178 AEs, 1.236/1000 AEs (95% CI: 1.104-1.383); IRR = 1.166 (95% CI: 1.015-1.339)]. There was no difference between the field turf [N = 138, 0.335/1000 AEs (95% CI: 0.284-0.369)] and grass [N = 72, 0.294/1000 AEs (95% CI: 0.233-0.370)] for muscle strains [IRR = 1.142, 95% CI: 0.859-1.519]. Field turf [N = 361, 0.877/1000 AEs (95% CI: 0.791-0.973)] was associated with a significantly greater rate of ligamentous sprains compared to grass [N = 167, 0.681/1000 AEs (95% CI: 0.585-0.793); IRR = 1.288 (95% CI: 1.072-1.547)]. In particular, anterior cruciate ligament (ACL) injuries had an IR that was over 50% greater on field turf [N = 80, 0.194/1000 AEs (95% CI: 0.156-0.242)] compared to natural grass [N = 31, 0.126/1000 AEs (95% CI: 0.089).

Conclusions: Previous literature indicates field turf may modestly increase the risk of ankle injuries compared to grass, but there are inconsistent findings regarding knee/ACL injuries. Our findings of a higher risk of sprains and, in particular, ACL injuries on field turf in comparison to the prior literature suggest that surface type effects may differ significantly by athlete sex, sport, and playing level.

Significance: Given the low representation of studies including women athletes across a range of sports and levels, decision-making regarding surface use and athlete safety may rely on heavily biased data. Greater research equity is needed in this area of study.