Epidemiological profile of pain and non-steroid anti-inflammatory drug use in collegiate athletes in the United States

Authors: Christopher S, ATC, PT, DPT, Tadlock, BA, SPT, Veroneau BJ, SPT, Harnish C, PhD, Perera NKP, PhD, Knab AM, PhD, Vallabhajosula S, PhD, Bullock GS, PT, DPT.

1 Department of Physical Therapy Education, Elon University, NC, USA
2 Department of Exercise Science, Mary Baldwin College, Staunton, VA, USA
3 Kinesiology Department, Queens University of Charlotte, Charlotte, NC, USA
4 Centre for Sport, Exercise and Osteoarthritis Research Versus Arthritis, University of Oxford, UK
5 Nuffield Department of Orthopaedics, Rheumatology, and Musculoskeletal Sciences, University of Oxford, Oxford, UK
6 Unit of Physiotherapy, Department of Health, Medicine and Caring Sciences (HMV), Linköping University, Linköping, Sweden
7 School of Allied Health, Human Services and Sport, Latrobe University, Melbourne, Victoria, Australia
8 Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, North Carolina, USA

Corresponding Author Information

Garrett S. Bullock PT, DPT
Nuffield Department of Orthopaedics, Rheumatology, and Musculoskeletal Sciences
University of Oxford
B4495
Oxford, United Kingdom
OX3 7LD
(865) 227-374
garrettbullock@gmail.com
ABSTRACT

Background: Although athletic endeavours are associated with a high amount of physical stress and injury, the prevalence of pain is underreported in the sports medicine literature with only a few studies reporting pain on collegiate athletes or exploring sex difference of pain. Impact of pain on athlete availability, training and performance can be mitigated when key epidemiological information is used to inform adequate pain management strategies. To 1) provide an epidemiological profile of self-reported pain experienced by the National Collegiate Athletic Association (NCAA) athletes by sex during the first half of the 2019 season, 2) describe their self-reported non-steroidal anti-inflammatory drug (NSAID) use.

Methods: Online survey was completed by athletes at three NCAA institutions from 1 August to 30 September 2019. Descriptive statistics were used to describe player demographic data, self-reported pain and self-reported NSAID use. Pain incidence proportion were calculated.

Results: 230 female athletes and 83 male athletes completed the survey. Self-reported pain incidence proportion for female athletes was 45.0 (95% CI 41.5-48.5) vs 34.9 (95% CI 29.4-40.4) for male athletes. Majority of the athletes did not report pain (55% female vs 62% male) during the first half of the 2019 season. Female athletes reported pain in their back (35%), knee (26%), and ankle/foot (23%) whilst male athletes reported pain in their knee (35%), back (28%), and shoulder (24%). Of all athletes, 28% female vs 20% male athletes reported currently taking NSAIDs. Of athletes that reported pain, 46% female vs 38% male athletes currently took NSAIDs. 70% female vs 61% male athletes self-purchased NSAIDs, and 40% female vs 55% male athletes consumed alcohol.

Conclusions: Half of female athletes and one in three male athletes reported pain. Back, knee and foot/ankle pain and knee, back and shoulder pain is common in female and male athletes respectively. One in four female athletes and one in five male athletes use NSAIDs for pain or prophylactic purpose. Majority self-purchase these medications indicating need for health literacy interventions to mitigate potential adverse effects.

KEY WORDS: Sleep, Female Athletes, Sports Medicine, health literacy, athlete health, injury prevention, elite sport
1. BACKGROUND

The National Collegiate Athletic Association (NCAA) is a United States and Canadian-based non-profit organisation that regulates and organises sports for over 480,000 student athletes in more than 1,200 colleges and universities. The NCAA programs have three tiers, namely division one, division two, and division three athletic programs. The NCAA competition is the highest level of competition for collegiate athletes with many NCAA athletes on athletic scholarship, potentially contributing to increased pressure to play. Collegiate athletes, like many competitive athletes, invest substantial amount of time and effort to meet the physical demands of their sports. As a result, their bodies are under considerable amount of strain and pain. Pain can be a precursor to the development of an overuse injury, over training, or associated with illness, and can decrease performance, training, and overall athlete availability.

Pain is multidimensional, incorporating neurological, biomechanical, and psychological constructs. Pain response varies between sexes, with females having a greater response to painful stimuli and overall pain reporting compared to males. Although athletic endeavours are associated with a high amount of physical stress and injury, the prevalence of pain is underreported in the sports medicine literature with only a few studies reporting pain on collegiate athletes or exploring sex difference of pain. Impact of pain on athlete availability, training and performance can be mitigated when key epidemiological information is used to inform adequate pain management strategies.

Various methods are used by athletes to minimise the impact of pain during training and competition. One pain management strategy is the use of Non-Steroidal Anti-Inflammatory Drugs (NSAID), a class of medications that reduces pain, decreases inflammation, and fever. Side effects depend on the specific NSAID, but the most common side-effects include an
increased risk of gastrointestinal upsets, ulcers and bleeds, bronchospasm, bruising, raised liver enzyme, and kidney disease. Some NSAIDs (except aspirin) can increase the risk of heart attack and stroke, potentially life-threatening even in healthy people. Further, if NSAIDs are used without medical guidance, drug interactions with other medicines could cause unwanted effects. To reduce risk of side-effects, NSAIDs must be used cautiously and occasionally rather than daily, at the lowest effective dose possible for the shortest time. Since NSAIDs are easy to access and affordable, athletes of all backgrounds frequently use it without any medical advice. Given the potential poor health literacy among athlete population, prolonged use of NSAIDs, particularly prophylactic misuse is concerning. For example, athletes were unable to differentiate between competition and training related soreness, and injury related pain, potentially leading to indiscriminate pain management strategies. Also, athletes are known to consume high amount of alcohol, taking high doses of NSAIDs (male athletes consumed 8% more NSAIDs compared to the general population) and for more than a few days at a time (10% of male athletes take NSAIDs prior to each competition). Regular use of NSAIDS can increase the risk of gastrointestinal bleeding in individuals who consumed alcohol. Owing to these known risk factors and prophylactic misuse of NSAIDs without appropriate medical advice, athletes are a NSAIDs high-risk group for developing serious complications. Also, NSAID consumption might be different between sexes, for example female athlete report more pain, but data on NSAID use is not available. General lack of data from a well-defined athlete population hinder development of evidence-based health literacy interventions as well as inform medical professional to deliver appropriately targeted care.
This study aims to 1) provide an epidemiological profile of self-reported pain experienced by NCAA athletes by sex during the first half of the 2019 season, 2) and describe their self-reported NSAID use.

2. METHODS

This cross-sectional survey was part of a larger collegiate health and well-being study on: (1) athlete general health; (2) lifestyle and academics; (3) pain, injury, and surgery and (4) well-being. Survey was adopted from the cricket health and well-being study21 and pilot tested by three researchers (BT, VB, GB), three current collegiate athletes and a collegiate athletic trainer. Following ethics approval from the Elon University Institutional Review Board (ID: 20-026), a link to the online survey and the plain language information statement was disseminated by the sports medicine staff at three NCAA institutions (Elon University, Queens University of Charlotte, and Mary Baldwin College) to 1,239 NCAA athletes via email. The online survey was live from 1 August to 30 September 2019 (8-weeks), inclusive via the Qualtrics software (Qualtrics, Provo, UT) and took average of 12 minutes to complete. To reduce participant burden, athletes could save their responses and return to complete the survey at their leisure. Two email reminders were sent at weeks two and six and verbal reminders were given by coaches during week four. Inclusion criteria was 1) an NCAA athlete who is enrolled at one of the three participating institutions, and 2) listed on the official roster for their sport. Study participant recruitment is illustrated in Figure 1. The survey included 19 questions relating to player demographic characteristics, sports participation, pain, and NSAID use (Appendix A).
Main outcome measures are current self-reported pain due to illness and injury reported using the Oslo Sports Traumatic Research Centre for Overuse Injury Questionnaire (OSTRC) where 0 = no pain, 8 = mild pain, 17 = moderate pain and 25 = severe pain. Pain scores were then dichotomised into no pain (score of 0) and presence of pain (score of >0) for analysis. If athletes reported pain, they were asked to list affected joints (Appendix A). Athletes NSAID use was the second main outcome measure and assessed using the question, “Are you currently taking any Non-Steroidal Anti-Inflammatory Drug at this time for any reason for your sport?” (Appendix A). In order to make meaningful sport comparisons, sports were categorised into collision sport (American football, rugby, and lacrosse), field and court sport (basketball, football, tennis, and volleyball), bat-and-ball and ball-and-stick sport (baseball and softball), and individuals sports (cross country, dance, golf, swimming, track and field, and triathlon).

Descriptive statistics were used to describe player demographic data, self-reported pain and self-reported NSAID use. Pain incidence proportion, with 95% confidence intervals (95% CI) for all athletes and by sex was calculated using the following formula.

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\text{Pain incidence proportion} = \frac{\text{# of athletes reported pain}}{\text{# of all athletes}} \times 100
\]

The relationship between self-reported NSAID use and self-reported current pain was explored using unadjusted and adjusted logistic regression with 95% CI’s. All logistic regression models were adjusted for Body Mass Index (BMI), alcohol use, surgical history, injury history, and
number of hours sleeping. All statistical analyses were performed in R version 3.5.1. When possible, categories were broadened in a meaningful way to ensure ≥5 cases to protect athletes’ privacy. All data cells corresponding to counts of <5 were replaced by an asterisk (*) in the presentation of results in order to ensure confidentiality.

Missing data were analysed through counts, percentages, and visualisation through the R package naniar. Missing data was determined to be low, and that variables were missing at random except for where athletes receive NSAIDs (Appendix B). Due to this, participant data was split for descriptive analyses into missing and not missing groups for the NSAID questions. Mann-Whitney U and chi-square tests were performed between groups for age, BMI, NCAA division, surgical history, and injury history and no differences were observed between groups. It was concluded that missing data for the question where athletes receive NSAIDs was missing not completely at random (MNAR). Further, due to these findings, logistic regression models only analysed NSAID use or no NSAID use, and all other data relating to NSAID use were analysed descriptively.

3. RESULTS

A total of 1,239 male and female athletes received the survey. The survey response rate was 26% where 230 female athletes (Division 1: 39%, Division 2: 33%, and Division 3: 28%) and 83 male athletes (Division 1: 52%, Division 2: 19%, Division 3: 29%) completed the survey. Median age of female and male athletes was 19.0 (18-20) and 20.0 (19.5-20.5) years respectively. Majority (37% female vs 51% male) were Freshman and most athletes played field and court sports (42% female vs 33% male) (Table 1).
Self-reported pain incidence proportion for female athletes was 45.0 (95% CI: 41.5 - 48.5) vs 34.9 (95% CI: 29.4 - 40.4) for male athletes. Sport specific self-reported pain incidence proportion for collision sport played by female 100.0 (95% CI: 100.0, 100.0) vs male 69.2 (95% CI: 56.4 - 82.0)); field and court sports played by female 44.3 (95% CI: 39.3 - 49.4) vs male 44.4 (95% CI: 34.9 - 54.0); bat-and-ball and ball-and-stick sports played by female 31.5 (95% CI: 25.2 - 37.8) vs male 19.2 (95% CI: 11.5 - 7.0); individual sports played by female 40.8 (95% CI: 35.0 - 46.7) vs males 20.0 (95% CI: 9.7 - 30.3).

Majority of the athletes did not report pain (55% female vs 62% male) during the first half of the 2019 season. Of the athletes who self-reported pain, most athletes reported mild pain (76% female vs 59% male). Sex differences observed where 13% female vs 83% male athletes who reported pain had a history of an injury that led to >4 weeks’ time loss from sport. Most of the self-reported pain was by athletes who played field and court sport (47% female vs 41% male). Of the athletes with current pain, 40% female vs 55% male athletes consumed alcohol. (Table 2).

Female athletes reported the greatest prevalence of back pain (35% female vs 28% male), compared to male athletes who reported the greatest prevalence of knee pain (26% female vs 35% male). Female athletes reported a high prevalence of pain in their ankle/foot (23% female vs 14% male), in comparison to males who reported a high prevalence of shoulder pain (16% female vs 24% male; Figure 2).
<Insert Figure 2: Anatomical location of the self-reported joint pain in female and male collegiate athletes during the first half of the 2019 season>

Of all athletes, 28% female vs 20% male athletes reported to currently taking NSAIDs.

Of the athletes that reported pain, 46% female vs 38% male athlete currently consume NSAIDs.

Also, 21% female vs 15% male athletes that did not report pain were taking NSAIDs (Table 2).

41% female vs 63% male athletes reported never consuming NSAIDs during the off-season and 30% females vs 47% males never consumed NSAIDs during the season. The majority (70% female vs 61% male athletes), self-purchased NSAIDs. Female athletes that currently consume NSAIDs, 36% had consumed alcohol in the past 30 days vs 37% of male athletes (Table 3).

Female athletes that reported current pain had greater odds of currently taking NSAIDs (Unadjusted: 1.11 (95% CI: 1.05 - 1.17), p < 0.0001; Adjusted: 1.10 (95% CI: 1.03 - 1.16), p = 0.002). Male athletes that reported current pain had greater unadjusted odds of using NSAIDs (Unadjusted: 1.11 (95% CI: 1.03 - 1.21), p = 0.009). However, there was no adjusted relationship (Adjusted: 1.08 (95% CI: 0.97 - 1.21), p = 0.176).

4. DISCUSSION

One of the most important findings of the present study was that self-reported pain incidence proportion was higher in female athletes and almost half of female athletes compared
One in three male athletes reported pain. We found that one in four female athletes and one in five male athletes were currently using NSAIDs and almost one in two female and male athletes with current pain consumed alcohol.

Female athletes reported greater pain incidence in comparison to males. Females have a greater response to painful stimuli and overall pain reporting, and are more susceptible to chronic pain conditions, sensitive to pain threshold and tolerance, and readily report pain compared with males. Despite playing similar sports and competing at the same standard of play, females reported greater pain incidence; however, females were overrepresented in this sample. Nevertheless, these results potentially suggest that female collegiate athletes may have different potential pain responses to similar sporting activities, and that clinicians should consider these pain response differences between sexes when monitoring and evaluating collegiate athletes. Sex differences were observed for the anatomical location of joint pain. Female athletes reported pain in their back, knee, and ankle/foot and males reported pain in their knee, back, and shoulder. Interestingly, while females usually have a higher risk of knee pain, these results demonstrated that the greatest pain prevalence was to back in female athletes. Further, prevalence of back pain was greater in female athletes than males. The disparity in back pain reporting has been attributed to hip muscular imbalances due to anatomical and strength differences between sexes. Low back pain has also been associated with lower extremity pain and injury in female athletes, such as to the knee or ankle/foot, further corroborating our results. The prevalence of lower extremity pain, specifically to the knee and foot/ankle may be due to the increased risk of lower extremity injury in females. These anatomical pain discrepancies between females and males should be considered when evaluating and interpreting collegiate athlete pain.
One in four female and one in five male athletes were currently taking NSAIDs, and our findings are comparable to existing evidence.6,22 Further, half of female athletes and one in three male athletes with current pain consumed NSAIDs. Alarming, one in five female athletes and one in seven males athletes that did not report pain were taking NSAIDs, likely for prophylactic purposes.14 Athletes potentially use NSAIDs in order to reduce the debilitating effects of pain in pursuit of remaining competitive and available.14 Further concern is that 70% female athletes vs 61% male athletes self-purchased NSAIDs and likely consumed these medications without any medical advice. A previous study of male NCAA athletes reported that NSAIDs were purchased by individual athletes (59%) and family members (22%).22 However, this study only investigated male college athletes at one NCAA institution in comparison to our study where both female and male athletes at multiple NCAA institutions were investigated.22 There is a low barrier to obtaining NSAIDs, they are relatively cheap and easily purchased over the counter. Personal use of over the counter NSAIDs use in athletes is socially acceptable and can lead to unsupervised consumption.20 We found 36% of female and 37% of male athletes that reported taking NSAIDs also reported high alcohol use. This is of particular concern, risk of adverse reactions increase owing to interaction between alcohol and NSAIDs.27 General lack of health literacy among athletes may have contributed to improper understanding of drug properties and improper NSAID use.6,20 High alcohol consumption, combined with prophylactic misuse of NSAIDs, without medical advice increase the risk of serious complications. 5,14,27 Collegiate athletic departments and sports medicine clinicians need to educate athletes and their families on appropriate NSAID use and alternative pain management strategies, and monitor NSAID consumption.
Increased alcohol consumption has been linked to increased pain levels in adults with lower back pain and adolescent athletes. Collegiate athletes consume more alcohol than collegiate non-athletes. We found 40% female vs 55% male athletes with current pain consumed alcohol. Increased alcohol consumption in adolescents and young adults with pain has been proposed as a coping mechanism in an attempt to diminish the negative psychological effects of pain. Sports medicine clinicians should monitor overall alcohol consumption in athletes that are experiencing pain. Further, sports medicine clinicians need to increase collegiate athlete pain health literacy in order for athletes to help these athletes self-monitor their own alcohol consumption.

Pain is multidimensional and the epidemiological profile of pain can change throughout the year. Collegiate athletes train and compete in sport throughout the year and our data only provide a snapshot at a single point in time. Therefore, ongoing surveillance is needed to understand the seasonal changes to the athlete pain profile and NSAID use throughout the year.

One obvious limitation of a cross-section study like this is the potential for recall bias, particularly for injury and surgical history and off-season NSAID use. It is also possible that athletes may have over or under reported their NSAID use. Also pain perception is subjective. However, use of questions from previously validated surveys for pain and NSAID use could limit the impact by being comparable to previous literature. Another limitation is that the response rate was 26% and most of the responding athletes were females, thus generalisability of our findings might be limited in male collegiate athlete populations. However, research into female athletes are limited; thus, these data help address the general lack of research into the female athlete. Only a small number of athletes participating in collision sports completed the survey, limiting generalisability of these results to these populations as pain profiles might be
different. Further, most athletes included in this study were Caucasian, decreasing the
generalisability of these findings to other ethnic groups. However, typically collegiate athletes
are homogenous population, and therefore behaviours such as NSAID use and accessing these
medications, and alcohol use might be similar. Finally, as only an online survey was used, results
might be subject to single method bias. As pain and pain management is complex, mix methods
and qualitative research are needed explore these complex multi-dimensional constructs.

5. CONCLUSIONS

Half of female athletes and one in three male athletes reported pain. Back, knee and
foot/ankle pain and knee, back and shoulder pain is common in female and male athletes
respectively. One in four females and one in five males reported currently using NSAIDs for
pain and for prophylactic purposes. Most of female and male athletes reported obtaining NSAIDs
through self-purchase. Athletes who consumed NSAIDs and those who reported pain also
consumed high amount of alcohol. These results suggest that collegiate athletes consume
NSAIDs without medical supervision for pain, and there is a need to investigate and intervene on
health literacy within this population, in order to potentially curtail harmful health consequences.
List of Abbreviations

NCAA = National Collegiate Athletic Association

NSAID = Non-Steroidal Anti-Inflammatory Drugs

OSTRC = Oslo Sports Traumatic Research Centre for Overuse Injury Questionnaire

95% CI = 95% Confidence Intervals

BMI = Body Mass Index
DECLARATIONS

Ethics Approval and consent to participate: This study was approved by Elon University Institutional Review Board (ID: 20-026). All participants self-identified as meeting the eligibility criteria and gave written consent to participation.

Consent for publication: Not applicable

Availability of data and materials: Data is available upon reasonable request to the authors

Competing Interests: All authors affirm that they have no involvement with any commercial organization that has a direct financial interest in any matter included in this manuscript.

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Authors Contributions: GSB, SC, SV, BT, BV, AK, CH conceived the study idea. GSB, SC, SV, BT, BV, AK, CH, NP were involved in methodological design and planning. GSB, SC, SV, BT wrote the first draft of the manuscript. GSB, NP contributed to statistical analyses. GSB, SC, SV, BT, BV, AK, CH, NP all critically revised the manuscript. GSB, SC, SV, BT, BV, AK, CH, NP all approved the final version of the manuscript.

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1. National Collegiate Athletic Association. Our Three Divisions. http://www.ncaa.org/about/resources/media-center/ncaa-101/our-three-divisions. Published 2019. Accessed.

2. Nestel D. Athletic scholarships: An imbalance of power between the university and the student-athlete. Ohio St L J. 1992;53:1401.

3. Warner DC, Schnepf G, Barrett MS, Dian D, Swigonski NL. Prevalence, attitudes, and behaviors related to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) in student athletes. J Adolesc health. 2002;30(3):150-153.

4. Clarsen B, Myklebust G, Bahr R. Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire. Br J Sports Med. 2013;47(8):495-502.

5. Da Silva ER, De Rose EH, Ribeiro JP, et al. Non-steroidal anti-inflammatory use in the XV Pan-American Games (2007). British journal of sports medicine. 2011;45(2):91-94.

6. Holmes N, Cronholm PF, Duffy III A, Webner D. Nonsteroidal anti-inflammatory drug use in collegiate football players. Clin J Sport Med. 2013;23(4):283-286.

7. Elton D, Stanley GV, Burrows GD. Psychological control of pain. Grune & Stratton, Inc; 1983.

8. Greenspan JD, Craft RM, LeResche L, et al. Studying sex and gender differences in pain and analgesia: a consensus report. Pain. 2007;132(S26-S45).

9. Kinart CM, Cuppett MM, Berg K. Prevalence of migraines in NCAA division I male and female basketball players. Headache: J Head Face Pain. 2002;42(7):620-629.

10. Kujala UM, Orava S, Parkkari J, Kaprio J, Sarna S. Sports career-related musculoskeletal injuries. Sports Medicine. 2003;33(12):869-875.

11. Stache S, Close JD, Mehallo C, Fayock K. Nonprescription pain medication use in collegiate athletes: a comparison of samples. Physician Sportsmed. 2014;42(2):19-23.

12. Finch C. A new framework for research leading to sports injury prevention. J Sci Med Sport. 2006;9(1-2):3-9.

13. Harle CA, Danielson EC, Derman W, et al. Analgesic management of pain in elite athletes: a systematic review. Clin J Sports Med. 2018;28(5):417-426.

14. Warden SJ. Prophylactic misuse and recommended use of non-steroidal anti-inflammatory drugs by athletes. In: British Association of Sport and Exercise Medicine; 2009.

15. Cryer B, Barnett MA, Wagner J, Wilcox CM. Overuse and misperceptions of nonsteroidal anti-inflammatory drugs in the United States. Am J Med Sci. 2016;352(5):472-480.

16. Bennett JS, Daugherty A, Herrington D, Greenland P, Roberts H, Taubert KA. The Use of Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) A Science Advisory From the American Heart Association. Circulation. 2005;111(13):1713-1716.

17. Mehallo CJ, Drezner JA, Bytomski JR. Practical management: nonsteroidal antiinflammatory drug (NSAID) use in athletic injuries. Clin J Sports Med. 2006;16(2):170-174.

18. Matava MJ. Ethical considerations for analgesic use in sports medicine. Clin Sport Med. 2016;35(2):227-243.

19. Nattiv A, Puffer JC, Green GA. Lifestyles and health risks of collegiate athletes: a multicenter study. Clin J Sport Med. 1997;7(4):262-272.

20. Selanne H, Ryba TV, Siekkinen K, et al. The prevalence of musculoskeletal pain and use of painkillers among adolescent male ice hockey players in Finland. Health Psych Behav Med. 2014;2(1):448-454.
21. Cai H, Bullock GS, Sanchez-Santos MT, Peirce N, Arden NK, Filbay SR. Joint pain and osteoarthritis in former recreational and elite cricketers. *BMC Musculoskeletal Disorders*. 2019;20(1):596.

22. Davis BR. Non-Steroidal Anti-Inflammatory Drug Use in Collegiate Athletes. 2015.

23. Knowles SB, Marshall SW, Guskiewicz KM. Issues in estimating risks and rates in sports injury research. *J Athl Train*. 2006;41(2):207.

24. Roos KG, Marshall SW, Kerr ZY, et al. Epidemiology of overuse injuries in collegiate and high school athletics in the United States. *Am J Sports med*. 2015;43(7):1790-1797.

25. Nadler SF, Malanga GA, Feinberg JH, Prybicien M, Stitik TP, DePrince M. Relationship between hip muscle imbalance and occurrence of low back pain in collegiate athletes: a prospective study. *Am J Phys Med Rehabil*. 2001;80(8):572-577.

26. Nadler SF, Malanga GA, DePrince M, Stitik TP, Feinberg JH. The relationship between lower extremity injury, low back pain, and hip muscle strength in male and female collegiate athletes. *Clin J Sports med*. 2000;10(2):89-97.

27. Neutel CI, Appel WC. The effect of alcohol abuse on the risk of NSAID-related gastrointestinal events. *Annal Epidemiol*. 2000;10(4):246-250.

28. Ferreira PH, Pinheiro MB, Machado GC, Ferreira ML. Is alcohol intake associated with low back pain? A systematic review of observational studies. *Manual therapy*. 2013;18(3):183-190.

29. Jussila L, Paananen M, Näyhä S, et al. Psychosocial and lifestyle correlates of musculoskeletal pain patterns in adolescence: A 2-year follow-up study. *Eur J Pain*. 2014;18(1):139-146.

30. Ayer L, Rettew D, Althoff RR, et al. Adolescent personality profiles, neighborhood income, and young adult alcohol use: a longitudinal study. *Addictive Behaviors*. 2011;36(12):1301-1304.
Figure Legend

Figure 1. Study Participant Flow Chart

Figure 2. Anatomical location of the self-reported joint pain in female and male collegiate athletes during the first half of the 2019 season