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Variability in the identification and reporting of overuse injuries among sports injury surveillance data collectors

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Abstract

Purpose: This study examined variability in identifying and reporting overuse injuries among Certified Athletic Trainers (ATs).

Methods: This cross-sectional study of ATs participating in the National Collegiate Athletic Association's Injury Surveillance Program, utilized a novel online-only survey, consisting of seven hypothetical clinical scenarios representing various clinical presentations including overuse and acute elements. Participants reported clinical opinions regarding the role overuse played in each scenario (major contributor, not a major contributor, not enough information) and probability (0–100%) of classifying each scenario as having an overuse injury mechanism, then completed open-ended questions addressing their decision-making process.

Results: 74 ATs (25%) completed the survey. Six of the seven scenarios generated discordance in responses among the participating ATs. Variability in AT decisions involved: the progression of injury, duration of symptoms, and activity at time of injury.

Conclusion: Developing a formalized definition of overuse injury may improve consistency and standardize methods for identifying and reporting overuse injuries within injury research.

Introduction

Overuse injuries in sports are characterized by the accumulation of microtrauma as a result of repetitive activity.[1–3] This trauma can affect many tissues, including bone, muscle, tendon, and ligament.[4–7] These injuries typically do not have a single specifically identifiable incident associated with their onset, and their slow and graduated progression make them difficult to identify.[8–11] Overuse is generally characterized as resulting from repetitive stress or inadequate rest between activities, however, there is currently no formal operational definition of "overuse injury".[3] The lack of a formal definition has the potential to result in variability when documenting information about overuse injuries. This is common in sports injury research that has examined overuse injuries and will specifically affect the variability of the data elements commonly used in injury surveillance systems, such as mechanism of injury, injury onset date, and diagnosis for overuse injuries.[12,13]

Athletic trainers (ATs) are health care professionals trained to diagnose, treat, and prevent sports injuries in many settings including high schools, colleges and universities.[14,15] Documentation of injuries is an integral part of AT clinical care. The National Collegiate Athletic Association's Injury Surveillance Program (NCAA-ISP) utilizes ATs to collect data

regarding injuries in collegiate sport, including factors related to the athlete, injury, outcome, and specifics of each sporting event.[16,17]

It is important to understand how college ATs arrive at diagnostic, treatment and reporting decisions for clinical and research purposes. Injury surveillance data is of particular interest, as these systems are widely used by researchers and are also utilized for decision-making by administrators and sports medicine and rules committees.[17] Injuries that are difficult to diagnose and clinically define, such as overuse injuries, may have high variability between clinicians and this variability has the potential to create ambiguity in the results from any data collected.[18,19] Reliable data is critical for the evaluation of current and development of future treatment and prevention strategies.

Learning about how ATs define and report these injuries may lead to improvements in instruction and definitions for research purposes and potential modules for clinical education. The purpose of this investigation was to describe the variability in individual diagnostic and reporting practices among college ATs who collect data for the NCAA-ISP. This investigation examined 1) how ATs determined whether overuse played a role in the development of a specific injury, 2) once the ATs made that determination, how likely they would be to report to the NCAA-ISP that the mechanism of injury was overuse, and 3) how they arrived at their decisions with respect to overuse and the reporting of overuse.

Methods

Research design and participants

This investigation used an online instrument that consisted of seven hypothetical clinical injury scenarios (designed by injury experts and athletic trainers) representing a range of clinical presentations including elements of both overuse and acute injury. All scenarios included some degree of ambiguity regarding the mechanism of injury, as typical among many clinical injury evaluations. All 293 ATs contributing data to NCAA-ISP in October 2014 were invited to complete the online instrument. This study was determined to be exempt from review by the <<removed for blind review>> IRB.

Clinical scenarios and their development

Participating ATs were presented with seven hypothetical clinical scenarios. Each scenario (A through G, See Table 2) described the clinical history of an athlete presenting to the athletic training room. Each of the seven hypothetical clinical scenarios presented differing information and differing amounts of information regarding subjective reports of symptoms and history of the injury, sport participation and previous injury history, clinical objective findings, results of clinical special and medical tests and rehabilitation outcomes. These scenarios were specifically constructed to represent a range of combinations of overuse and acute mechanisms, and the details of injury onset were intentionally ill-defined and vague. The scenarios were designed to approximate athletic training room clinical care, where there are often gaps in the information available to the clinician, and athlete responses and clinical signs can be ambiguous. Scenarios B, D, E, F and G were independent of each other; two scenarios (A and C) were linked (the same athlete over one season).

The survey instrument and injury scenarios were developed by the primary author (a former college AT) with input from five additional injury researchers and five different AT clinicians. As part of the instrument development, in-depth interviews were conducted with five AT graduate students to determine 1) the appropriateness of the scenarios, 2) how the scenarios were understood, 3) the decision-making processes used to complete the survey, and 4) whether the survey accurately captured these processes. An additional 13 individuals including ATs and graduate students were consulted regarding the content, ease, and comprehension of the survey instrument itself.

Role of Overuse and Probability of Reporting Overuse as the Mechanism of Injury

We asked a series of closed and open-ended questions following each scenario, including: 1) each AT's opinion of the contribution of overuse to that individual scenario (hereafter referred to as *Role of Overuse*), 2) the likelihood of assigning an overuse mechanism of injury to that individual scenario (hereafter referred to as *Probability of Reporting*) and 3) how each AT reached those conclusions.

To assess *Role of Overuse*, ATs were asked to select the response that best matched the contribution of overuse in each injury scenario using a closed scale with four response options: "Overuse is the major contributor to this injury", "Overuse is a limited contributor to this injury", "This injury is not overuse related at all", and "Not enough information". To assess the *Probability of Reporting*, each AT was asked to select the probability (from 0–100% on visual analog scale with sliding pointer) that he or she would assign overuse as the mechanism of injury for that scenario when reporting the injury to the NCAA-ISP. Each AT was also asked an open-ended question regarding their decision making process (for both *Role* and *Reporting*) for each scenario: "How did you reach these conclusions?"

Recruitment and data collection

The Datalys Center for Sports Injury Research and Prevention (Datalys Center, Indianapolis, IN) conducts the NCAA-ISP. [17] An email invitation was sent on October 1, 2014 to all 293 ATs who were currently participating in the NCAA-ISP. Two survey reminders were sent to ATs who had not completed the survey at one and two weeks. The survey closed on October 22, 2014. Only completed surveys were included in analyses. A total of 113 ATs (38.6%) consented to participate and began the survey, and 74 completed it (25.3% response rate). Incentives ($25 gift cards) were mailed to all participants who provided contact information at the conclusion of the completed survey. These incentives were funded by a doctoral grant from <<removed for blind review>>.

Assessment of Concordance and Majority Opinion

The variability in clinical decision-making for each scenario was assessed. Variability was operationalized using two major axes: Concordance (three levels) and Majority Opinion (two levels).

The Concordance axis represented the level of concordance or discordance among ATs responses to questions regarding the *Role of Overuse* and *Probability of Reporting*. (Table 1). Based on empirical examination of percent agreement for the *Role of Overuse* and the

interquartile range for the *Probability of Reporting*, we defined three broad categories of response for Concordance, which we termed Type 1, 2, and 3. Type 1 comprised scenarios that generated general concordance among ATs (over 75% of responses to *Role of Overuse* were in agreement regardless of value, and the interquartile range for *Probability of Reporting* had a width 25% or less falling entirely between 0 and 25% or 75 and 100%), Type 2 comprised scenarios that generated moderate discordance (over 50% of responses to *Role of Overuse* were in agreement, and the interquartile range for *Probability of Reporting* had a width 50% or less falling entirely between 0 and 50% or 50 and 100%), and Type 3 comprised scenarios that generated major discordance (<75% agreement regarding *Role of Overuse* and the interquartile range for *Probability of Reporting* included 50% regardless of width).The number of missing values was also used a criteria for classification of Concordance. (Table 1)

The scenarios were also classified based on Majority Opinion as to whether overuse was the predominant contributing factor to the injury. Based only on the *Probability of Reporting*, scenarios where the majority of ATs (>50%) considered the injury overuse related were labeled OV (overuse), and scenarios where the majority of ATs considered the injury not overuse related were labeled N-OV (not overuse).

Quantitative Analysis

Discordance and Majority Opinion axes were combined to create an overall classification system including a number for Discordance (Types 1, 2 or 3) and a label for Majority Opinion (OV or N-OV, Table 2). Thus a classification of 1OV would indicate that there was concordance in the assignment and reporting of an overuse mechanism of injury. A classification of 3N-OV would indicate major discordance in reporting the mechanism of injury between ATs for a scenario that the majority determined to be “not overuse”. The variability in the responses for each scenario was assessed and presented by interquartile ranges, standard deviations (SD) and box and whiskers plots.

Qualitative analysis

A directed content analysis, defined as qualitative data analysis using preliminary categories of previously identified variables or themes (a theory or idea that was both present and clearly communicated in a text response) and adding new themes as analysis progressed, was conducted for all qualitative responses to the question: “How did you reach these conclusions?”[20] (20) All text responses were read by the primary investigator and first coded according to themes regarding the ATs’ 1) perceptions of the mechanism of injury in each scenario, 2) criteria for assigning overuse as a mechanism of injury, and 3) processes for reporting the mechanism of injury within the NCAA-ISP. Additional themes were added throughout this process. Themes common to multiple ATs in response to individual scenarios were noted.

Results

Survey participants

Of the 74 ATs who completed the survey, 62.2% were male (n=46), and the mean age was 37.6 years old (SD: 9.4; range: 25–59). A large proportion of participants had masters degrees (n=63, 85.1%) with 27.0% of those degrees in athletic training. Respondents were board-certified for an average of 14 years (SD: 9.1; range: <1–36 years), and 60.8% were in their current job for 5+ years (range: <1–20+ years).

Results of the analyses of the *Role of Overuse* and *Probability of Reporting* are shown in Table 2 and Figure 1, respectively. Six of the seven scenarios generated moderate (n=4) or major (n=2) discordance in responses among the participating ATs. Only one of scenarios generated concordance.

Scenarios generating concordance (Scenario A)

For Scenario A (shoulder injury in softball) 85.1% of ATs assigned an overuse mechanism to the scenario *(Role of Overuse)*, and half of ATs reported a probability of 92.5% or higher of reporting an overuse mechanism of injury (*Probability of Reporting*), classifying this scenario as Type 1. Despite this high level of concordance, there were four ATs who reported <50% probabilities of reporting an overuse mechanism of injury to Scenario A.

Two main qualitative themes from Scenario A (shoulder injury in softball) were identified. The first main theme was the progression of the injury presented in the scenario, specifically the description of how the injury changed over time; for example “increase of pain as the season progresses.” The second theme was that the injury had no specific mechanism; that the mechanism of injury was either missing from the injury event overall or missing from the written scenario (e.g., “There was no specific activity that started this injury”).

This scenario was more detailed than the other seven, and ATs listed specific findings from the scenario such as “A history of an overuse injury (biceps tendinopathy) in the right shoulder preceding right anterior shoulder pain, along with rotator cuff weakness, biceps weakness, a positive speed’s sign, positive impingement and no specific mechanism would lead me to believe the major cause of this injury is overuse” and “Athlete. has a history of biceps tendinitis. / Shoulder weakness / No acute mechanism of injury / Positive impingement and tendinitis tests.”

However, nearly 11% of ATs reported that this was not an overuse injury. These ATs offer a dissenting opinion characterized by a delineation between the current symptoms and a previous history of injury: “Overuse is only a contributing factor in that this is at least the second time that she had this injury to her pitching shoulder.”

Scenarios generating moderate discordance (Scenarios B, C, D, E)

Four scenarios were classified as Type 2 (moderate discordance). Scenario B (elbow pain in baseball) was classified as 2OV (moderate discordance, overuse was major contributor). Scenarios C (fall on arm in softball), D (back pain in crew) and E (back pain in swimmer) were classified as 2N-OV (moderate discordance, overuse not major contributor). For *Role*

of Overuse, Scenario D (back pain in crew) had the highest percentage of ATs in one category (93.0% endorsed overuse is not a major contributor), and Scenario B (elbow pain in baseball) the lowest (68.9% endorsed overuse is the major contributor). Scenario B also had the highest percentage of ATs indicating "not enough information" (14.9% of *Role of Overuse* and 8% of *Probability of Reporting*).

For Scenarios C (fall on arm in softball), D (back pain in crew) and E (back pain in swimmer), which were all N-OV, at least half of the ATs reported a probability of less than 20% for reporting an overuse mechanism for these injures (*Probability of Reporting*). However, in each of these scenarios, one or two ATs reported 100% probability of reporting an overuse mechanism of injury (different ATs for each scenario). Scenarios C, D and E had a large number of ATs who appeared undecided or neutral concerning the Role of Overuse but still reported a relatively high probability of reporting an overuse mechanism of injury (between 45% and 55%).

A major theme that emerged from qualitative analysis of Scenario B (elbow pain in baseball, 2OV) was the duration of the injury; for example "the fact the pain has been going on for over one month." In Scenario E (back pain in swimmer, 2N-OV), the primary theme was that the scenario involved an acute event. These responses often discussed that a specific incident initiated the injury, for example "one specific mechanism that caused immediate symptoms that were not previously present."

Themes from Scenario C (fall on arm in softball, 2N-OV), demonstrated how carefully ATs weighed their responses to the *Role of Overuse* regarding overuse and acute elements; for example "Has an acute mechanism, with overuse history that at that point was asymptomatic". Responses to Scenario D (back pain in crew, 2N-OV) indicated that ATs used the same theme of overuse and acute elements contributed to that injury: "There was also a specific incident that led to worsening pain. Overuse would be a moderate factor in the final injury because that muscle was already problematic."

Scenarios generating major discordance (Scenarios F, G)

Scenarios F (thigh pain in soccer) and G (wrist pain in gymnastics) were classified as Type 3N-OV, (major discordance, overuse not major contributor). These scenarios had the most variability in the range of responses for the *Probability of Reporting* (Figure 1). This variability reflected bimodal distributions, with one cluster of ATs reporting extremely high probability of reporting the injury as overuse (scenario F: 7 responses over 85%; scenario G: 20 responses above 85%;), and another cluster who reported extremely low probability of reporting the injury as overuse (scenario F: 8 responses below 10%; scenario G: 12 responses below 10%). There were also 10 (13.5%) and 13 (17.6%) respondents (for scenarios F and G respectively) who were apparently neutral and endorsed between 45% and 55% probability of reporting the injury as overuse. These scenarios also had the highest percentages of ATs indicating "not enough information" (scenario G: 27.0% for *Role*, 9.5% for *Report*; scenario F: 12.2% for *Role*, 9.5% for *Report*).

These scenarios clearly demonstrate the greatest ambiguity. In *Role of Overuse* they had a very slender majority for "not overuse", and an intermediate probability of reporting overuse

as the mechanism of injury (*Probability of Reporting*). For example, scenario G was classified not overuse by the study criteria (Table 2), even though the largest percentage (45.9%) of respondents reported that the injury was due to overuse mechanisms. In this scenario, a mean probability of 59.2% for reporting an overuse mechanism masks the polarization of ATs who suggested an extremely high or low probability of reporting an overuse.

Two major themes were identified for scenario F (thigh pain in soccer): 1) the injury was acute, often without explanation of how that mechanism was assigned, and 2) both overuse and acute mechanisms contributed to this injury. For example “acute mechanism of kicking ball – would note tightness as contributor to injury” versus “Overuse is probably a predisposition. Environmental factors and use during the game caused the acute injury”. The duration of the injury was another common theme, however, this theme was applied in different ways, “three weeks should be considered chronic, therefore, overuse must be considered”, versus “Three weeks of DOMS [sic Delayed Onset Muscle Soreness]. One visible action created this injury”.

In scenario G (wrist pain in gymnastics), the primary qualitative theme involved the activity at the time of injury, often stating that the activity in the scenario was the cause of the injury, without assigning a mechanism: “She has been repetitively performing the same task with increased pain.” However, the theme of activity at the time of injury was sometimes combined with the theme of duration of the injury; “The fact that she is trying a new skill and has been working on it every day for 3 weeks”, and the theme of acute injury; “This is the body reacting to new movements and is re-educating muscles for this new movement. Not an overuse injury.”

Discussion

The major finding of this study is that six of seven scenarios generated, at minimum, a moderate degree of discordance in responses among participating ATs, indicating the presence of ambiguity in the assessment of the *Role of Overuse* and *Probability of Reporting*. The presence of discordance among ATs likely reflects the lack of a clear rubric or operational definition to provide guidance for clinicians in defining overuse injury.[10,21] It is gratifying to note that, when individual ATs reported that overuse was a major contributor to the injury, those ATs also reported a high probability of classifying overuse as the mechanism of injury within the NCAA-ISP. The converse was also true, supporting the face validity of the NCAA-ISP for monitoring overuse injuries.

Despite the face validity of the NCAA-ISP for overuse injuries, the presence and scope of ambiguous and contradictory responses to the majority of scenarios indicates that ATs personal practices for reporting overuse injuries likely have low inter-rater reliability, specifically in scenarios with incomplete information, and/or an unclear mechanism of injury. This is exemplified by the bimodal responses to scenario G; a scenario that featured a female gymnast who complained of a wrist pain after three weeks of trying a new handspring skill. While some ATs thought that the repetition necessary to learn a new skill led to an overuse related injury; others thought that the three weeks of a new skill were

unrelated to a single acute incident. These ATs demonstrated strong opinions regarding the probability of reporting an overuse mechanism, resulting in a polarization between extremely high and extremely low probability.

Such variation in AT perceptions and processes may be the result of variations in AT training, education and/or experience in the area of overuse injuries. This range of variability is also likely affected by the absence of a consensus definition for overuse injuries within research as a whole, and specifically injury surveillance.[13,22,23]

Scenario A (shoulder injury in softball) was the only scenario that generated concordance. This is likely due to the characteristics of the injury scenario, which were described in slightly greater detail, regarding a two-year history of shoulder dysfunction in a softball pitcher. The concordance found in scenario A indicates the potential that additional information may decrease the variability among responses.

The creation and adoption of a consensus definition, standardized data collection methods and the formalization of education regarding overuse injuries may assist with the assessment and reporting of these complicated injuries. Improving the standardization for reporting practices for these injuries, and decreasing variability among ATs will likely provide more consistent and accurate data regarding overuse injuries, and can assist with the creation and implementation of prevention strategies.

There are few studies which address the efficacy and consistency of injury surveillance to capture sports injuries.[22] The NCAA-ISP has been validated for ascertainment of the presences of injuries, but there is an absence of information regarding the processes which ATs use to evaluate the injuries which they report.[24] Junge et al in 2000 stated “Most authors who report the proportion of overuse injuries assume that the definition is well known and indisputable. However, substantial differences in the reported proportion of overuse injuries (6%, 9%, 34%, and 35%) lead one to conclude that dissimilar definitions were most likely applied.”[23] There is also debate regarding whether the operational definition for injury surveillance should include all injuries, or only those which result in time loss.[18,25,26] This has major implications for surveillance of overuse injuries, which may not initially involve time-loss.

There is limited literature regarding individual perceptions regarding overuse injuries. Currently, there is no available literature regarding how ATs perceptions of injuries influence how they evaluate and report them in general, much less for overuse injuries. In fact we found only one study which addresses any perceptions regarding overuse injuries. A qualitative study by van Wilgen and Verhagen[27] asked athletes and coaches about their beliefs regarding the incidence of overuse injuries. They found that the participants’ definitions for overuse injuries were either based on behavioral factors and imbalance between strain and rest, or physiological factors.[27] These themes were not found in the current data, likely due to the differences in study populations (ATs versus athletes and coaches), and the different ways these groups use injury information.

Future research

To improve validity and consistency, the development of a consensus definition for overuse injuries is recommended. However, a definition based solely on the duration of injury or symptoms is unlikely to be useful, as currently no guidelines exist for the amount of time that results in an overuse injury, and such a guideline would be challenging to formulate.[12]

Therefore, a syndromic definition, where the assignment of "overuse" is conferred after reaching a predetermined number of criteria from a list of diagnostic signs and symptoms, may be more appropriate. Other biomedical areas, such arthritis research, have struggled to develop a singular definition has been seen with pediatric arthritis.[28] There are complex challenges in defining and categorizing overuse; which like arthritis, is not limited to a specific body part or joint, and does not have a clear onset incident. The 2010 classification for definite rheumatoid arthritis employs a syndromic approach, requiring the presence of histological findings without a better, alternative diagnosis, and a cumulative score of at least 6 out of 10, from a set of criteria including locations of symptoms, additional histological findings and duration of symptoms.[28]

A syndromic definition for overuse might include the duration of the injury, the presence or absence of a progressive injury onset, the progression/evolution of the injury itself, changes in the athletes' functional ability, presence or absence from participation, and any fluctuations within participation, subjective reports of pain and function and measurable, objective findings.[2,3,29] Implementing such a methodology would allow for overuse to be identified by a cluster of symptoms rather than a specific diagnosis. This may increase the ease of identifying overuse injuries, for clinical and research purposes, which may in turn lead to greater consistency among ATs and in research data.

Limitations

Although all ATs who participated in the NCAA-ISP were invited, only 25% completed the survey, which may or may not be representative of the whole group. Additionally, "Hawthorne effects" cannot be eliminated; participants' reports of their practices may not be the same as their actual practices due to the nature of taking a survey as part of a research study. Finally, because the scenarios were generated independently of clinical records, the extent to which scenarios such as those presented here occur in routine clinical practice is unknown. However, content review and pilot testing did not indicate a marked departure from typical clinical practice.

Implications for injury surveillance and clinical documentation

The purpose of this current investigation was to describe how ATs operationalize overuse injuries. This is not to eliminate the individual approaches in diagnosis and management that reflect the natural variation in the practice of medicine, but to begin to fully understand and if the clinicians' assessments are accurately represented. The results of this study make it clear that there is ample ability to standardize the identification of overuse without limiting the normal variation in clinical practice. In order to assess that potential, the processes of those ATs must be put in context of the larger environment. Our results support the ability of the NCAA-ISP for capturing overuse injuries once identified. However, there is little to

demonstrate that the assessment of overuse is consistent between ATs.[10] A consensus definition may improve the consistency and generalizability of overuse injury results between studies,[8,13,18,22,30] and may increase the consistency between ATs, but the format of that definition must be able to encapsulate the broad range of clinical presentations inherent to overuse injuries. A crucial element will be incorporating this definition into AT education. Without implementation, any potential effects of a definition for overuse injuries, will be moot. Once assimilated into the lexicon of both clinical assessment and injury research, a common definition for overuse should produce accurate and comparable data to be used to identify the actual incidence of overuse injuries, as well as factors which contribute to those injuries. Such data would allow for the creation of interventions for early assessment and treatment of overuse injuries or protocols for prevention altogether.

Conclusion

Substantial variability was observed between ATs in the processing of overuse-like clinical scenarios. There is considerable potential for improving the consistency of sports injury surveillance data on overuse injuries. Developing a more formalized definition of overuse injury or adoptions of a syndromic classification system may improve the consistency.

Appendix

TABLE A

Hypothetical Injury Scenarios in Order of Presentation in the Online Survey Instrument[a]

Scenario 1 (Scenario 6): A baseball pitcher has been having elbow pain for over 1 month. He has been icing his elbow, but has declined injury assessment by the certified athletic trainer, He is unable to complete practice one day late in the season due to pain. He reports that he was mid-pitch when the pain became”too much.’On assessment, he has significant medial elbow tenderness, mild swelling, and a positiveTinel’s test for the ulnar nerve.

Scenario 2 (Scenario E): A swimmer presents to the athletic training room with low back pain after a session in the weight room.The athlete reports that he was doing plyometrlc trunk rotation by catching and throwing a 10 pound weighted medicine ball when he started to feel pain in his right lower back, He has been swimming two sessions a day and has been lifting 5 days a weekfor the past 9 months with occasional complaints of non-specific soreness after a hard practice. Upon evaluation, there is significant muscle spasm in the right lumbar paraspinals and radicular pain along the anterior right thigh consistent with the L3 dermatome.There is no evidence of rig ht q uadriceps weakness.The quadrant test, which axially loads the right lumbar facets by overpressure through the shoulders when the athlete is seated and the lumbar spine hyperextended with right rotation and side bend, amplifies the symptoms, indicating possible nerve root irritation.

Scenario 3 (Scenario F): A soccer goalkeeper has been complaining of dominant leg quadriceps pain and tightness for several weeks. His initial visit to the athletic training room was without an assessment and he has been receiving treatment of moist heat and stretching prior to practice and games and ice after practice and games since then, After 3 weeks of daily heat, stretch, and ice treatments, the athlete collapses after punting the ball in the second half of a game. He complains of significant dominant left quadriceps pain, and there is a visible and palpable defect in the muscle.This game was played outside, and it had been snowing for a short time. The ball was in play in the opposing team’s half of the field for the majority of the game.

Scenario 4 (Scenario G): A female gymnast has been working on a new skill on the balance beam that includes a back handspring. As a habit, she has always taped her wrists and ankles before and iced her wrists and ankles after each practice. After 3 weeks of practicing this skill, she presents to the athletic training room with complaints of right wrist pain, and an inability to complete practice. She presents with significant redness and swelling over the right anterior wrist. She has pain and crepitus with active wrist flexion and passive wrist extension.

Scenario 5 (Scenario D): A freshma n fema le with no history of participation in crew has just wa Iked-on to the team. She has participated in all trai ning, practices, and weig ht lifting activities. She presented to the athletic tra ining room with com plaints of low back pain, where she was assessed with a diagnosis of muscle strain. No diagnostic tests (x-rays or MRIs) were performed. She has been heating before practice and icing after practice, as well as performing basic low back exercises as part of a rehabilitation program. She presents to the athletic training room during one practice with reports of a significant increase in her back pain. She reports that she was lifting a boat with a teammate when the teammate lost her grip and the boat shifted significantly.They did not drop the boat, but worked quickly and in an awkward position to lower It to the ground. On evaluation she has significant paraspinal spasm, left more than right, and a left trunk shift, Diagnostic tests have not yet been performed.

Scenario 6a (Scenario A): A junior female softball player with a history of right biceps tendonitis her freshman year presents in midseason with complaints of right anterior shoulder pain. She pitches with her right arm, Evaluation demonstrates rotator cuff weakness, biceps weakness, a positive Speed's test, and positive impingement test, resulting in an assessment of biceps tendonitis.The athlete receives treatment and is placed on a rehabilitation program.

Scenario 6b (Scenario C): This same softball player was compliant with her rehabilitation program, performed exercises, and received treatment daily for 2 weeks. She then returned to fu II participation. One week after this retu rn to full pa rtlcipation the athlete fel I on an outstretched right arm during softball practice. Physical assessment at the second visit, confirmed byMRI presents a diagnosis of right full thickness labral tear and biceps tear.

MRI = magnetic resonance imaging

[a]For organization and presentation in the article, the order of scenarios was revised for clarity. The numbers and order are as presented in the original survey instrument. The letters correspond to scenario presentation in the article.

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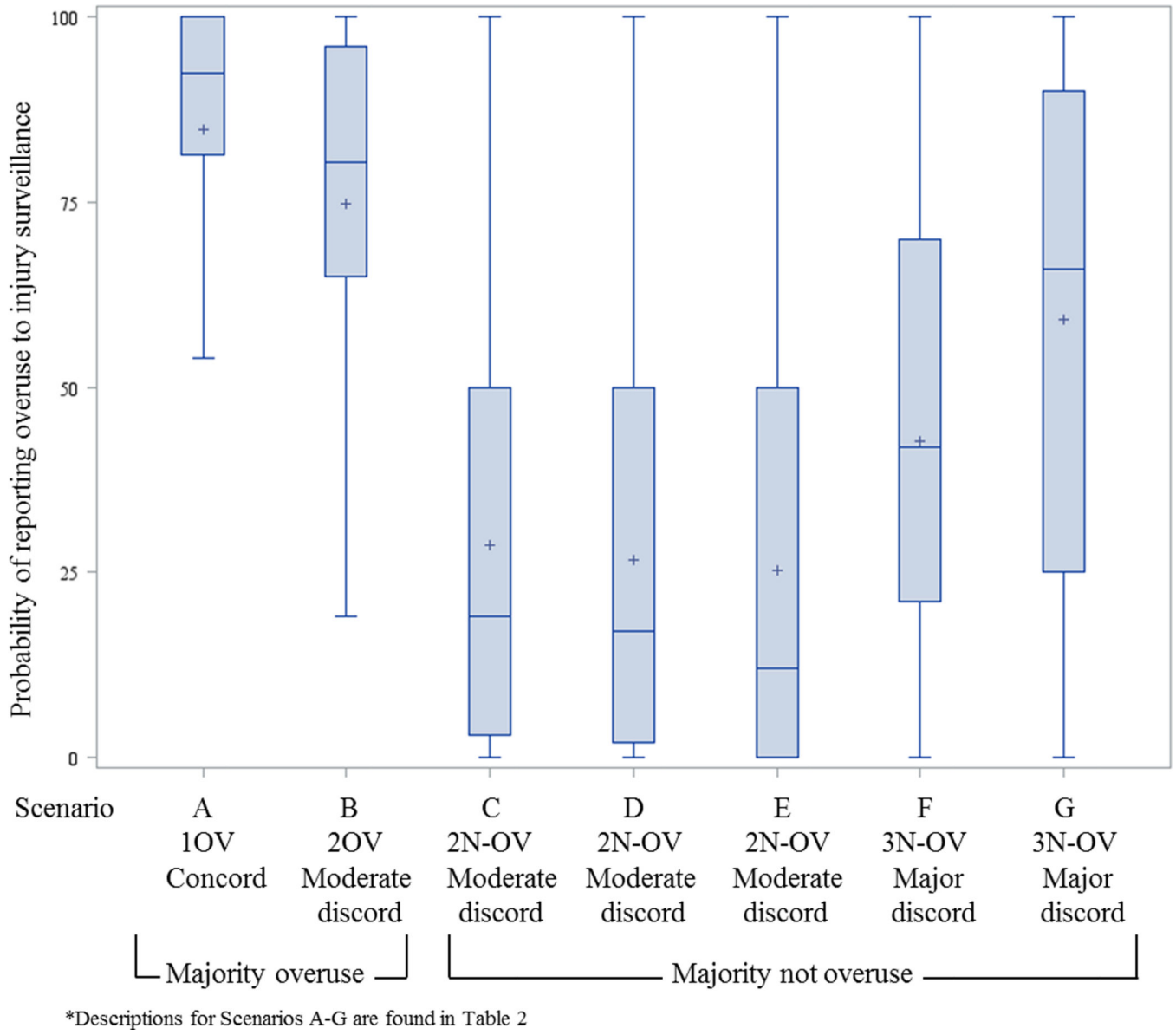

Figure1.

Distribution of the probability of reporting (Report construct) an overuse mechanism of injury by scenario, with designation of discordance classification

Table 1:

Criteria for categorizing individual injury scenarios into levels of discordance (using *Role of Overuse* and *Reporting of Reporting*)

	Type 1 – Concordance	Type 2-Moderate discordance	Type 3-Major Discordance
Question 1: *Role of Overuse*	> 75% of responses were in agreement	> 50% of responses were in agreement	< 75% of responses were in agreement
Question 2: *Probability of Reporting*	IQ[a] range for the probability of reporting an overuse mechanism of injury falls entirely between 0%–25% or 75%–100%.[b]	IQ[a] range for the probability of reporting an overuse mechanism of injury between falls entirely between 0%–50% or 50%–100%.[b]	IQ[a] range for the probability of reporting an overuse mechanism of injury includes 50%.[b]
Not enough information	Less than 5% missing for each question	Less than 10% missing for one or both questions	More than 10% missing for one or both questions
Other criteria		Not categorized as Type 1	Not categorized as Type 1 or Type 2

[a]IQ: Interquartile

[b]Missing values for Probability of Reporting varied by scenario (A, n=2; B, n=6; C, n=1; D, n=1; E, n=2; F, n=7; G, n=7) and were excluded from analysis.

Table 2:

Responses to question regarding the role of overuse in each scenario (n=74)

Scenario	Overuse is the major contributor	Overuse is not a major contributor	Not enough information[1]	Level of Discordance	Majority opinion	Discordance classification
Scenario A: A softball athlete with a history of shoulder pathology two years ago reports similar symptoms mid-season.	63 (85.1%)	8 (10.8%)	3 (4.1%)	*Concordance* (Type 1)	Overuse related (OV)	1OV
Scenario B: A baseball pitcher with elbow pain for over one month, has been icing but not evaluated by AT, is mid-pitch when pain becomes “too much”.	51 (68.9%)	12 (16.2%)	11 (14.9%)	*Moderate discordance* (Type 2)	Overuse related (OV)	2OV
Scenario C: The athlete from scenario A completed rehab on her shoulder, returns to full participation, then falls on that outstretched arm resulting in a significant shoulder injury.	8 (10.8%)	64 (86.5%)	2 (2.7%)	*Moderate discord*ance (Type 2)	Not overuse related (N-OV)	2N-OV
Scenario D: A new crew athlete has been having back pain prior to an episode of near dropping a boat, resulting in complaints of spasm and pain.	4 (5.4%)	69 (93.2%)	1 (1.4%)	*Moderate discordance* (Type 2)	Not overuse related (N-OV)	2N-OV
Scenario E: A swimmer with a history of significant sport involvement reports symptoms in his back after a rotation exercise in the weight room.	9 (12.2%)	63(85.1%)	2 (2.7%)	*Moderate discordance* (Type 2)	Not overuse related (N-OV)	2N-OV
Scenario F: A soccer goalkeeper with three week history of pain and treatment of thigh tightness collapses after punting the ball during a cold, uneventful game.	18 (24.3%)	47 (63.5%)	9 (12.2%)	*Major discordance* (Type 3)	Not overuse related (N-OV)	3N-OV
Scenario G: A gymnast has been practicing a new skill on the balance beam for three weeks and presents with wrist pain and an inability to practice.	34 (45.9%)	20 (27.0%)	20 (27.0%)	*Major discordance* (Type 3)	Not overuse related (N-OV)	3N-OV

[1]=Excluded from analysis of Level of discordance, Majority opinion and Discordance Classification

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