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Return-from-injury care teams and decision-making in the National Collegiate Athletic Association

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Abstract

Introduction. The role of a sports scientist is to provide context from research that aids in the decision-making process within sport/performance settings. Sports scientists have recently become more common at National Collegiate Athletics Association (NCAA) member institutions. Information about the composition of current NCAA member institutions' return-from-injury care teams, perceptions about the composition of an ideal care team, and athletic trainers' (ATCs) collaboration with professionals for shared decision-making is lacking. Aim of Study. The purpose of this study was to investigate current NCAA return-from-injury care team composition, perceived ideal composition, and the hierarchy of professionals involved in shared decision-making. Material and Methods. Two hundred fifty-three professionals working at NCAA institutions involved in return-from-injury care completed a web-based survey. Frequency analysis and correlations were used to report responses to closed-ended questions and thematic analysis was used for open-ended questions. The authors limited the findings to the application of sports scientist's roles, due to the aims of this study. Results. At the Division I level, the results indicated 11% of care teams currently include a sports scientist and 55% of the respondents would include a sports scientist on their ideal care team; at the Division II level, 2% and 60%; Division III level, 2% and 42%. ATCs ranked professionals relied on for return-to-sport decision-making. Based on mean values, sports scientist was ranked 11 out of 17. The rationale for current rank order included: using current workplace model, scope, available resources, hierarchy, and desire for athlete-centered and collaborative care. Conclusions. These findings fill known gaps regarding care team composition and decision-making at NCAA member institutions and support continued pursuit of improved return-from-injury shared decision-making models.

KEYWORDS: rehabilitation, return to play, interdisciplinary, return to sport, athletic trainer, sport scientist.

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Introduction

Sports scientists provide evidence-based advice to enhance sport performance and translate research into applied settings for all partners [2, 10, 12, 25, 26, 28, 30]. Sports scientists possess a high level of education in sports physiology, sports biomechanics, sport psychology, strength and conditioning, and sports nutrition, and often hold an advanced degree (i.e., PhD) specific to the sport performance industry [13, 14, 25]. They are trained to collect and analyze various types of data and identify trends and patterns to make objective decisions that will best serve the athlete. Sports scientists possess a high-level understanding of intrinsic and extrinsic workload progressions (acute and chronic) that impact the readiness for return to performance such as running and jumping loads [16]. Knowledge pertaining to competition demands and periodization models can positively impact planning the rehabilitation program [16]. The knowledge and skills these scientists have

would be advantageous for continued improvement in sport performance and return-from-injury processes and outcomes managed by interdisciplinary high-performance models such as those seen at various National Collegiate Athletic Association (NCAA) institutions [7, 10, 12, 13, 16, 17, 26, 27]. Documented return-from-injury rates in the NCAA remain at less than 85% for athletes who did not successfully return to full, unrestricted sessions after injury [7, 17, 27]. Furthermore, many institutions do not formally track and publish their return-from-injury outcomes, leaving much unknown. Sports scientists have an opportunity for growth and integration of their skills in a critical area across the NCAA, allowing them to serve over 520,000 elite athletes [21].

Inherent challenges exist with moving towards a more collaborative interdisciplinary model across the NCAA [8]. Workplace constraints, including communication and organizational structures, pose challenges for what scope of practice and roles/responsibilities for a sports scientist would look like in an applied setting [3, 14, 15, 26]. Additionally, there are varying credentials and educational backgrounds of sports scientists [12, 13, 25], creating challenges to understanding the scope of practice and roles and responsibilities in specific settings. Moreover, due to differences in financial resources between NCAA divisions and conferences, there is a potential for large discrepancies to exist regarding the composition of the care teams and the allocated resources for return-from-injury care [3, 15, 22]. These discrepancies may also lead to differences in education level, specialty certifications, and experience/years in role of the care team professionals, which could impact the return-from-injury care beyond what can be determined simply from the composition of the care team alone. There has also been a shift in care team structures, with medical care being provided by an outside, independent medical provider, where the team physician works with the designated health care administrator in overseeing other members of the athletic medical team [20]. Workplace infrastructure and resources may initially create barriers to effectively integrating an interdisciplinary high-performance model that emphasizes athlete-focused holistic health and performance support [13, 26]. This highlights the need to evaluate return-to-sport collaboration and care team composition, which may elevate the role of sports scientist. NCAA leadership may do well to establish specific policy recommendations or requirements for member institutions to employ interdisciplinary high-performance support teams [13].

Currently, NCAA handbooks outline how the certified athletic trainer (ATC) is the designated care coordinator for return-from-injury care [20, 24]. ATCs work under the supervision of a physician, who typically focuses on the injury, rather than the overall performance and fitness of the athlete [18, 24]. Sports scientists use key performance indicators to analyze sport in a unique and comprehensive way that complements and supports the roles of ATCs, strength and conditioning coaches, and sports coaches [26, 28]. While a team physician is responsible for clearing an athlete to return to activity [24], ATCs often see athletes on a more regular basis than the physician in the transition to return to sport, supporting their large role in return to sport decision-making and clearance [18]. Because of the large influence ATCs have on athletes returning to sport and performance, a sports scientist is in a position to use their unique skill set in areas such as data analytics, applying research concepts, and interdisciplinary communication and dissemination to directly support both the ATC and consequently the athlete [12]. Strength and conditioning coaches can also apply research and make decisions based on objective data provided by the sports scientist [4, 13]. For example, a sports scientist may conduct pre-season baseline testing of an athlete's performance in return-to-sport protocols commonly utilized in the specific sport (e.g., hamstring strength testing in American football). Thus, if an injury is to occur during the season, sports scientist may provide objective data and context to the return-to-sport process. Therefore, ATCs and strength and conditioning coaches are key partners in understanding how a sports scientist can contribute to optimizing athlete's performance and return-from-injury outcomes in the NCAA setting.

Currently, information about care team composition and perceived ideal care team composition is lacking. Prior to pursuing inclusion efforts, exploration of an organization's need is a critical first step. Information about shared decision-making for return-to-sport clearance, beyond the role of the ATC and physician, is also lacking. This is important information to obtain before taking next steps towards improved collaborative practice and a better understanding of overall care team operations. Return-from-injury care, including associated decision-making, is only one facet of applying the high-performance model in the NCAA setting; but it is an area of high interest [1, 4, 6, 7, 8, 9, 16, 17, 23, 27, 29, 30]. With the push for inclusion of sports scientist on interdisciplinary care teams in return-from-injury care [10, 12], it is relevant to assess how many current NCAA member institutions'

care teams currently include a sports scientist, how many professionals desire a sports scientist to be part of their ideal care team, and where ATCs rank sports scientists in terms of professionals with whom they collaborate for return-to-sport decision-making. In this study, decision-making for return to sport is defined as decisions that lead to the transition of the athlete being cleared to return to sport-specific activities and partial participation in competition, but not yet performing at pre-injury level [1].

With the increased number of credentialed sports scientists, increased education about the role of a sports scientist, and increased desire to optimize performance and outcomes, the role of a sports scientist is a growing profession. This warrants further investigation into associated emerging areas of interest [4, 10, 12, 26, 28, 30] such as the role of a sports scientist within return-from-injury care teams across the NCAA as part of large-scale efforts to improve return-from-injury outcomes. Anecdotally, it appears the industry is shifting toward the inclusion of sports scientist on care teams. There are ample frameworks, position statements, foundational reasoning, and theories about the role and integration of a sports scientist on interdisciplinary care teams [2, 9, 12, 13, 14, 16, 26, 28, 30]. To assess the value of applying these recommendations at NCAA institutions, it is necessary to explore current perspectives held by care team professionals working at these institutions.

Aim of Study

The purpose of this study was to collect and analyze survey data from professionals involved in the athlete rehabilitation continuum at NCAA institutions, specifically about current composition of return-from-injury care team and ideal composition of care team. Additionally, the authors sought to identify who ATCs rely on the most, and why, for shared return-to-sport decision-making to fill known gaps, explore reasoning involved in shared decision-making, and reveal areas of opportunity. Lastly, relationships between education level, number of specialty certifications, experience/length of time in professional role, and NCAA division were analyzed to reveal any trends that may need to be further explored.

Materials and Methods

Experimental Approach to the Problem

Two hundred fifty-three professionals working at NCAA institutions involved in return-from-injury care completed a web-based survey, and results were analyzed. A cross-sectional study design was employed. The respondents were asked questions related to the composition of their current return-from-injury care team and their ideal care team. A follow-up question was directed to ATCs only, as the designated care coordinators at NCAA member institutions, prompting them to rank the other professionals based on who they rely on/collaborate with the most for shared return-to-sport decision-making. ATCs were then asked to describe their rationale for their rank order. The authors limited the findings to the application of sports scientist roles, due to the aim of this study.

Subjects

The participants of the study were professionals working within the athlete rehabilitation continuum at NCAA member institutions. The sample consisted of: strength and conditioning coaches, ATCs, sports coaches, physicians, mental health providers, registered dietitians, sports nutritionists, physical therapists, and sports scientists. The study was approved by the Regis University Institutional Review Board (#2112583). All survey respondents were required to provide consent prior to accessing the survey.

Procedures

A 10-minute web-based survey (Qualtrics, Provo, UT) was developed by the research team from literature spanning 2007-2022. Original questions were tested by a small convenience sample (six relevant professionals associated with one institution) and adjusted based on feedback. The survey was distributed via email addresses gathered from public websites, to professionals who work with NCAA athletes. This survey was available from January 17, 2024 through February 17, 2024. The survey requested basic demographic information. Survey questions were not forced-response, with the exception of the consent. The full survey included questions investigating three domains: 1) professional roles and responsibilities including role in decision-making; 2) care team composition; and 3) workplace interprofessional education. Data from the second domain related to care team structure were reported on in this specific study. The survey can be found in Appendix A.

Statistical Analyses

Data from the online survey were downloaded into a Microsoft Excel Spreadsheet (Office Suite 2019, Microsoft, Redmond, WA). Frequency of responses and means were used to report the results for the

fixed-response questions. Open-ended response data were analyzed using an inductive coding process. Responses to qualitative questions were coded by two authors (EC, RD). These two authors read the data in its entirety, individually coded, and then collectively reviewed the responses. This process led to a concordance of themes to explain the phenomenon of interest. Accuracy of interpretation and combining of smaller themes into larger themes were assessed through investigator triangulation, in which another author (MC) reviewed the data. Indexing was used to code the themes. The use of the four cognitive processes – comprehending, synthesizing, theorizing, and contextualizing, allowed for data reduction and analysis [19]. A summary of predominant themes was analyzed by all the researchers to reach consensus.

Relationships between variables were analyzed and expressed as means, standard deviations, and 95% confidence intervals. Relationships between education level, number of specialty certifications, experience/length of time in professional role, and division were assessed using the Spearman's rank correlation coefficient (r_s) in separate pair groups in IBM SPSS Statistics version 26 (IBM, Armonk, NY). A moderate effect size of 0.5 (Cohen's d) was used to help describe pairwise comparisons. An a priori alpha level of $p \leq 0.05$ was used to qualify statistical significance for all analyses. The magnitudes of the correlations were interpreted through the following standard: trivial = 0.0-0.1, small = 0.1-0.3, moderate = 0.3-0.5, large = 0.5-0.7, very large = 0.7-0.9, and nearly perfect = 0.9-1.0 [5].

Results

The sample of respondents (n = 253) (19% response rate) included various professionals who work at (n = 224) or with (n = 29) NCAA member institutions within the rehabilitation continuum. The length of time/experience in their respective professional positions ranged from a few months to 47 years. Two hundred and twenty one respondents (87.4%) indicated they had one or more certifications within their respective area of expertise. The responses were totaled and categorized based on the NCAA Division representation (Division I [DI], n = 138; Division II [DII], n = 42; Division III [DIII], n = 46) (Table 1). See Figure 1 for sample sizes for data analysis.

There was a significant small correlation $r_s = 0.299$ (small is 0.1-0.3) between Divisions and number of certifications with Division I professionals holding more certifications [p = 0.001 (n = 253)] [5]. There was a significant small correlation $r_s = 0.155$ (small is 0.1-0.3) between Divisions and level of education with DI professionals indicating a higher level of education [p = 0.014 (n = 253)] [5]. There were no significant correlations between any other paired variables: Division, years in role, education level, and number of specialty certifications.

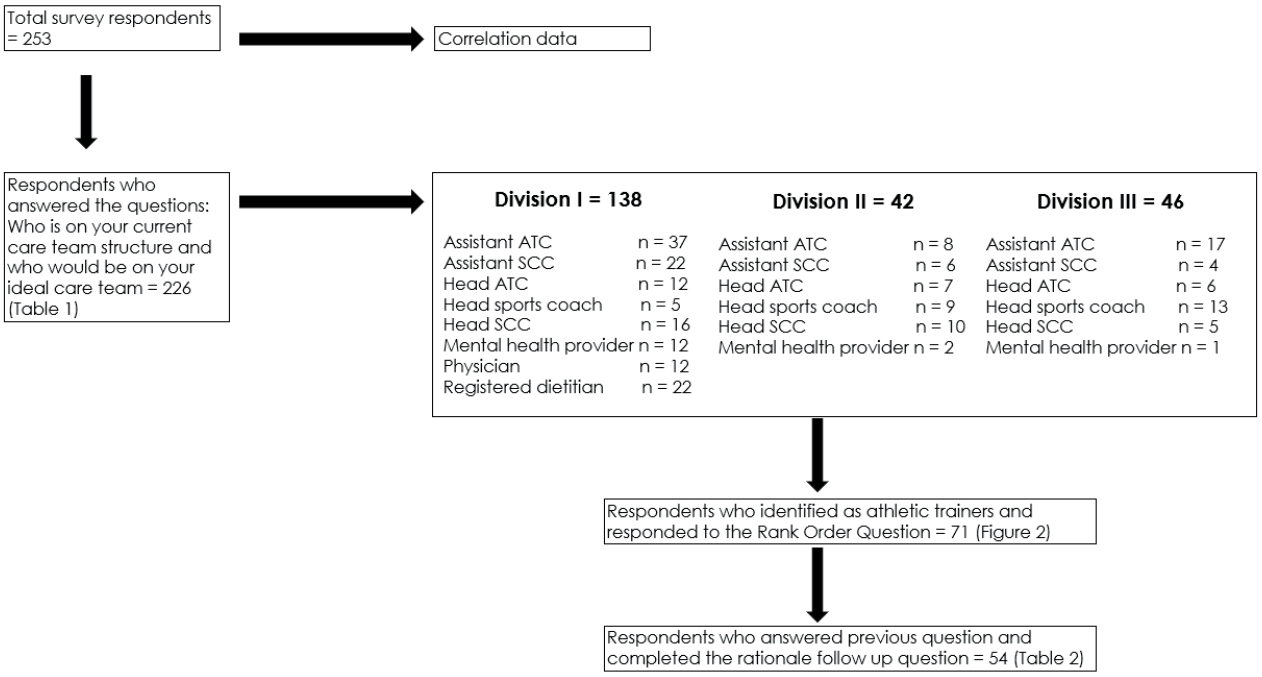

Figure 1. Flow for data analysis

Table 1. Comparison of current and ideal care team composition

Care team professional title as item to select	Division I (n = 138 total)			Division II (n = 42 total)			Division III (n = 46 total)		
	Currently on return-from-injury care team	Ideally would be on return-from-injury care team	Difference	Currently on return-from-injury care team	Ideally would be on return-from-injury care team	Difference	Currently on return-from-injury care team	Ideally would be on return-from-injury care team	Difference
Sports scientist	11%	55%	↑ 44%	2%	60%	↑ 58%	2%	42%	↑ 40%
Head SCC	50%	68%	↑ 18%	43%	71%	↑ 28%	42%	82%	↑ 40%
Assistant SCC	47%	54%	↑ 7%	31%	50%	↑ 19%	24%	40%	↑ 16%
Graduate assistant SCC	6%	8%	↑ 2%	5%	17%	↑ 12%	4%	13%	↑ 9%
Head ATC	60%	74%	↑ 14%	81%	83%	↑ 2%	87%	91%	↑ 4%
Assistant ATC	78%	76%	↓ 2%	79%	76%	↑ 3%	78%	78%	0
Head sports coach	49%	58%	↑ 9%	67%	74%	↑ 7%	62%	76%	↑ 14%
Assistant sports coach	32%	38%	↑ 6%	29%	38%	↑ 9%	27%	33%	↑ 6%
Graduate assistant sports coach	1%	1%	0	7%	7%	0	2%	9%	↑ 7%
Physical therapist	59%	73%	↑ 14%	57%	64%	↑ 7%	53%	73%	↑ 20%
Physician	85%	88%	↑ 3%	76%	81%	↑ 5%	80%	91%	↑ 11%
Surgeon	71%	77%	↑ 6%	62%	67%	↑ 5%	51%	73%	↑ 22%
Nutritionist	14%	37%	↑ 23%	5%	36%	↑ 31%	7%	38%	↑ 31%
Registered dietitian	28%	52%	↑ 24%	0%	21%	↑ 21%	0%	29%	↑ 29%
Mental performance coach	13%	48%	↑ 35%	7%	60%	↑ 53%	7%	60%	↑ 53%
Sport psychologist	33%	80%	↑ 47%	5%	62%	↑ 57%	7%	71%	↑ 64%
The athlete	76%	83%	↑ 7%	83%	83%	0	76%	82%	↑ 6%
Respondents	assistant ATC n = 37; assistant SCC n = 22; head ATC n = 12; head sports coach n = 5; head SCC n = 16; mental health Provider n = 12; physician n = 12; registered dietitian n = 22			assistant ATC n = 8; assistant SCC n = 6; head ATC n = 7; head sports coach n = 9; head SCC n = 10; mental health provider n = 2			assistant ATC n = 17; assistant SCC n = 4; Head ATC n = 6; head sports coach n = 13; head SCC n = 5; mental health provider n = 1		

Notes: ATC – certified athletic trainer, SSC – strength and conditioning coach

At the DI level, results indicated that 3 out of 17 categories had a difference of greater than 33% between current care team and ideal care team. There was a 44% difference between current care teams that include a sports scientist (11%) and ideal care teams with a sports scientist (55%). At the DII level, results indicated that 3 out of 17 categories (the same 3 as in DI) had a difference of greater than 33% between current care team and ideal care team. There was a 58% difference between current care teams that include a sport scientist (2%) and ideal care teams with a sports scientist (60%). At the DIII level, results indicate that 4 out of 17 categories (including the same 3 as DI and DII) had a difference of greater than 33% between current care team and ideal care team. There was a 40% difference between current care teams that include a sports scientist (2%) and ideal care teams with a sports scientist (42%). Combined responses indicate the collective desire for a move towards including a sports scientist as well as sport psychologist and/or mental performance coach on ideal care teams. Survey respondents at the DIII level also expressed the desire for the inclusion of a strength and conditioning coach on their ideal care team. See Table 1 for full results.

The results revealed that the ATCs rank surgeons, physicians, and fellow ATCs as the professionals they rely on most (Figure 2). Based on mean values, the sports scientist was ranked 11 out of 17. The rationale provided by ATCs for the rank order for current shared decision-making included: using the current workplace model (59% of respondents with representative comment), scope (56%), available resources (41%), hierarchy (32%), and a desire for athlete-centered (26%) and collaborative care (11%) (Table 2). Full quotes were used to code and establish themes, with samples of representative answers included in Table 2.

Table 2. Briefly describe your rationale for the rank order you provided regarding who you rely on the most (rank #1) to who you rely on the least (rank last) when it comes to Return-to-sport decision-making

Themes	Percentage of responses with representative comment	Example quotations
This is our current model	59% n = 32	"who I trust and work with now in my position." (R5, DIII) "It's currently how we are functioning." (R9, DI) "Many of these people don't exist in our structure." (R41, DI) "We have a very strong AT staff and a close working relationship with our team physicians/ surgeons. Our nutrition and mental health access is more of a referral basis outside of the athletic department." "Any PT interaction is only if referred." (R48, DII) "It would depend on the scenario of the athlete because if the athlete is coming off of surgery then I would follow more of the guidelines of the physician. However, there is a line between when the protocols end and you have to rely on the feedback from the athlete and the coaches on if they believe they have returned to performance. I am an assistant athletic trainer so I just would make the decision and not ask my head to make final decisions unless I had questions. My school does not have a dietician, mental health performance coach, nutritionist or sports psych on staff but if we did my order would change." (R59, DI) "It's based on who I currently use on my care team." (R138, DII)
Scope of practice	56% n = 30	"I rely on the PTs as they have more contact with them than the physician and have the ability to do testing with the athlete in the clinic." "After the athlete we don't really give them input as they are not trained in medical or performance guidelines. Once we have released the athlete into sport specific things is when a coach will come into play to help identify weaknesses that need to be addressed in their performance." (R32, DI) "ATs have the most daily interactions with the athletes, followed by PTs. Surgeons and physicians generally only provide a broad guideline when it comes to return to participation/ sport/performance but are vital to the safety of athletes. Return to sport decisions should be based on safety first, strength second, and then followed by performance. Sport coaches should be the last ones to make such decision given the conflict of interest it may present when it comes to athlete safety." (R56, DI)

Based on available resources	41% n = 22	"Ranked on the if those members are/are not available at my institution." (R5, DIII) "We don't have access to some of these services." (R12, DIII) "Second half of list are nonexistent at [my] university." (R13, DIII) "I basically ranked 1-9 because 10-17 are not applicable in my situation." (R34, DI) "Many of these people don't exist in our structure." (R41, DI) "...The rest of the people on here, I don't have access to, so I don't use." (R74, DI)
Hierarchy	32% n = 17	"We follow directions given by professionals where they have the legal right in the case." (R2, DIII) "Coach should rarely, if ever, be involved. Medical staff should have the primary calls, but can be supported by sport psychologist/mental health/strength and conditioning as needed." (R37, DI) "Surgeons and physicians ultimately make guidelines and decisions for student athletes. Everyone else down the list compliments the athletic trainer that works with the program." (R50, DI) "The «athletic trainer» in general should be one role and would be the top person since they see the athlete the most and often are encouraging the athlete that they are ready. Physical therapists and the surgeon are helpful with making sure certain benchmarks are reached. The strength coach is up there because they also spend a lot of time with the athlete and know a lot about their lifting and cardio habits to know if they are at peak physical performance to return." (R68, DI)
Athlete-centered care	26% n = 14	"The athlete should always be at the top of this list. It is their body, their priorities and ambitions." (R47, DII) "The mental capacity of the athlete is then also an important factor for returning." "The athlete then needs to be able to say that they are comfortable being able to return to sport." (R78, DI)
Desire for collaboration	11% n = 6	"The Athlete is ultimately responsible for what is happening to their own body." "If a physical therapist is involved in their rehab that input is important. I wish we had a sport psychologist to help our athletes work through the process of healing mentally & physically. The surgeon/physician medical clearance is a must. S&C needs to be involved. The head coaches' input is crucial for timing and how they need that athlete back. An athlete often does not understand what the body needs for healing, so a nutritionist is very helpful. Wish we had access to one." (R15, DII) "The sport ATC and team physician have control in decision making but best decisions come with input from all parties involved in caring for the athlete, dependent on the situation and injury." (R55, DI) "we try to work as a team. If there is someone who disagrees with the decision, we try to talk about it and make changes." (R67, DIII)

n = 54 ATCs
Note: R – respondent, D – Division
Statements in quotations are direct statements taken from respondents with parts of answer most relevant to coded themes used as examples.

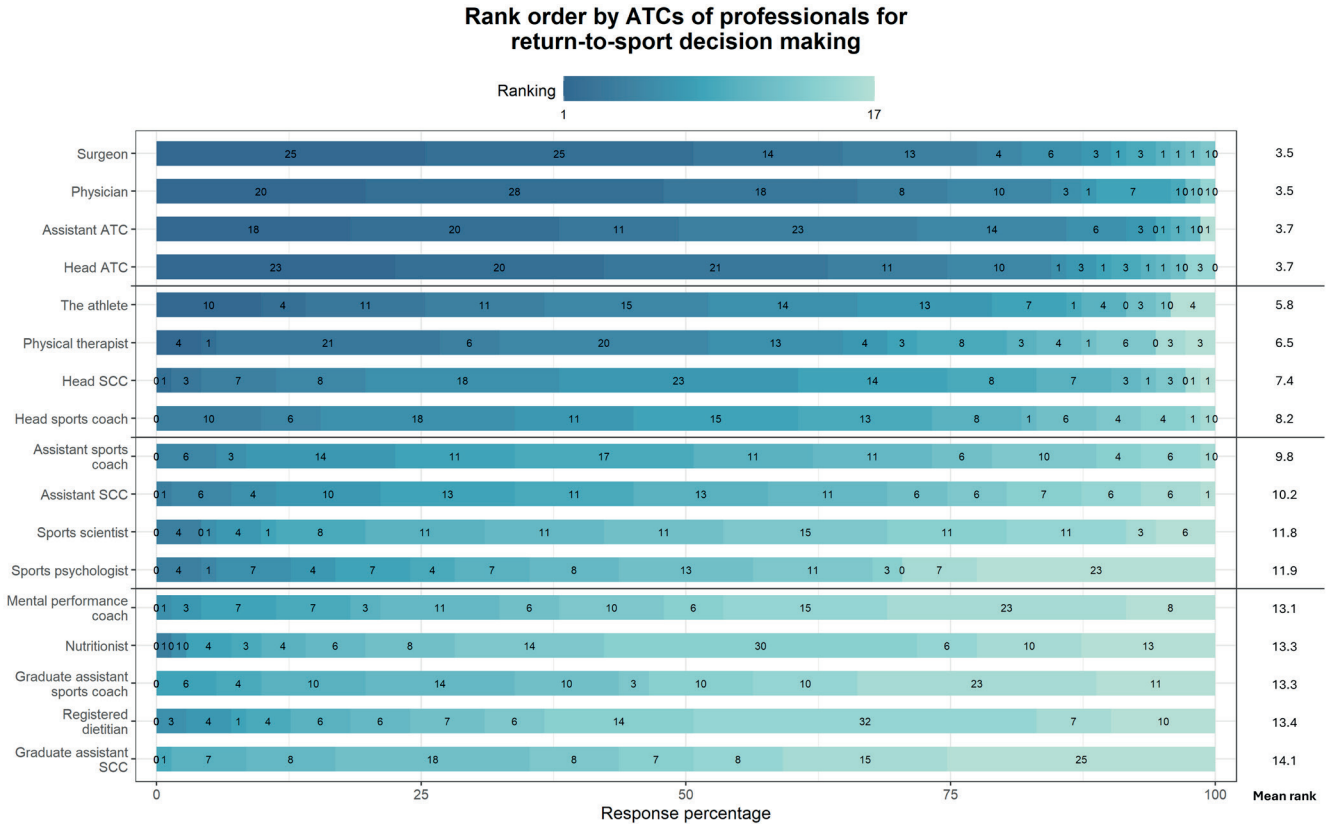

Figure 2. Ranking and mean

Discussion

This is the first study known to describe the current composition and perceived ideal composition of return-from-injury care teams for each division in the NCAA. The current findings report on sixteen different professional categories that are relevant to care teams at NCAA member institutions, in addition to the athlete (Table 1). The findings also report on how ATCs, as care coordinators in the NCAA setting, rank other professionals involved in return-to-sport decision-making. Based on the multidisciplinary results, the authors chose to highlight key findings specific to the sports scientist, one of the newest members [12, 13, 14], as well as future directions for this type of research on the topic of interdisciplinary care team structure and return-from-injury decision-making within the NCAA.

Based on this sample of NCAA professionals working at NCAA member institutions, 11% of return-from-injury care teams at the DI level, and 2% of care teams at the DII and DIII levels include a sports scientist. With the growth of the sports science industry and the role of sports scientist, these numbers are projected to increase in the future [12, 13, 14]. These data reveal key information regarding the current state of care team composition across the NCAA in 2024 in order to track growth and change over time. Additionally, these data reveal areas of opportunity to improve return-from-injury care and effective interdisciplinary approaches to athlete care through the inclusion of a sports scientist [12, 13, 14].

Overall, there is a perceived desire to include a sports scientist on return-from-injury care teams with 55%, 60%, and 42% of respondents, at the DI, DII, and DIII levels respectively, identifying that their ideal care team would include a sports scientist. While these percentages are not at 100%, which could be due to a multitude of reasons, they are suggestive of a desire to change. Rationales from ATCs include statements such as "sports science and objective data is very helpful in determining readiness" (Respondent 70). These findings corroborate many of the recent reports regarding the growth of the sports science profession and the desire to include sports scientists on care teams [12, 13, 14, 25, 26, 28]. However, there are varying workplace structures and constraints, even within divisions, which can create implementation barriers for the sports scientist role [3, 25, 28]. Organizational structure for effective inclusion of a sports scientist may depend on a number of factors including budget, intended outcomes, knowledge,

and available skills [14, 28]. Some organizational structures support a high-performance director that can design and optimize athlete management processes and fulfill many of the responsibilities of a sports scientist, as well as create and maintain a collaborative environment by reducing discipline-based silos [8]. This may be a preferred structure, if implemented effectively, but a larger labor force is required to truly support the high-performance model including high-volume data collection and analysis and supporting an interdisciplinary rehabilitation model for hundreds of athletes at one NCAA institution [8].

The current findings also revealed higher levels of education and an increased number of specialty certifications at the DI level. In combination with the increased financial resources at the DI level [3,22], these correlation data further support that DI institutions would be more likely to employ a professional with a sport science background compared to DII and DIII. While it might be financially feasible for some DI institutions to expand their high-performance models [3, 8, 15, 22], based on this research, only 55% of DI respondents desire to include a sports scientist on their care team (Table 1). While 55% (ideal care team) is a marked difference from 11% (current care team), this perception of an ideal care team presents another implementation challenge in and of itself. Although a primary consideration for inclusion may be financial resources, a secondary consideration is education regarding sports science scope of practice and how a sports scientist may add value to the return-from-injury decision-making process.

The current data present a disconnect between literature supporting the move to the inclusion of sports scientists [2, 10, 12, 13, 14, 25, 26, 28], financial resources available to make this a reality [3, 15, 22], perceptions of current professionals working at NCAA member institutions who report including a sports scientist on their ideal care team (Table 1), and the current NCAA model that designates the ATC as the care coordinator [20, 24] (Figure 2, Table 2). This intersection of information illuminates areas of opportunity for increased education about the current and future role of the sports scientist in the collegiate setting and the implementation of an effective care team structure regardless of a specific care team make-up [25]. There is also an opportunity, when financial resources do not allow for the role of the sports scientist to be included, for strength and conditioning professionals to serve as sports scientists in a modified capacity when qualified to do so (a dual-role) due to some overlap in the scope of practice and knowledge about exercise testing, sport-specific readiness, and load monitoring. Current care teams report higher instances of inclusion of a strength and conditioning professional compared to a sports scientist (Table 1), which could promote further definition of the role of the strength and conditioning professional on return-from-injury care teams, ultimately positively impacting the athlete and the professions of strength and conditioning and sports scientists [12, 13, 14, 25] when a dual-role qualified professional can be employed. The scope of the sports scientist and overlap with the strength and conditioning professional is still being developed and should continue to be explored in research and practice.

Care team structures will continue to vary across NCAA member institutions based on available resources [3, 6, 22]. The current findings help fill a known gap about current care team composition across NCAA member institutions, highlight a perceived desire for change, and provide data to help support the move to an effective interdisciplinary, collaborative high-performance model for return-from-injury care at NCAA member institutions [10, 30]. In addition to increased information about the composition of care teams (Table 1), variables associated with return-from-injury decision-making are equally as important to analyze as they relate to effective interdisciplinary collaboration (Figure 2, Table 2).

One outcome of the data for rank ordering professionals (by ATCs) for reliance on shared return-to-sport decision-making was the ability to determine where each professional was ranked (Figure 2, Table 2). Not only is it possible to determine where the sports scientist is ranked from this sample (11 out of 17), the data define the average influence of the athlete (ranked 5th), and strength and conditioning professional (head strength and conditioning coach ranked 7th), in shared decision-making. Roles and level of influence in return-to-sport decision-making will continue to vary based on workplace, but an outline that includes scope of practice and education of all professionals could arguably assist in generating an effective interdisciplinary care team plan for decision-making transition points and effective handoffs. For example, a sports scientist may conduct a needs analysis including wearable technology that allows for appropriate workload prescription and progression. The sports scientist could then support the return-to-sport process with athlete monitoring, assessing athletes' external workload, internal workload, perceptual well being, and readiness [11]. Ultimately, these skills can lead to the addition of objective data that add context to decision-making within return-to-play scenarios; increased awareness of roles could lead

to more effective inclusion and higher ranking of the sports scientist in the future.

The rank order of professional roles (Figure 2) also reveals how known education and experience levels can, in part, influence ranking. For example, a professional with the credential of MD, strikethrough a physician, ranks higher than a professional currently in pursuit of a master's degree, such as a graduate assistant. Hierarchical structure can influence decision-making, and many would argue that the chain of command helps avoid confusion and allows for designated leader(s). However, not all professionals have the same knowledge base or think about the rehabilitation continuum in the same way. Experiences and education, as well as daily interactions with the athlete, can all provide valuable information for shared decision-making. The sports scientist and the strength and conditioning coach may not be in a legal position to make the final recommendation for return to sport, but these professionals can certainly weigh in on testing outcomes, readiness, and risk of re-injury or new injury. The sports scientist can also support other professionals due to education in sport physiology, sports biomechanics, sports psychology, and sports nutrition [13]. The shared decision-making experience can also allow the high-performance team to work collaboratively to continue effective program design for an individual plan for the athlete to fully restore physical fitness at or above their pre-injury level [1, 4]. Specifically, a high-performance organization may adopt a multidisciplinary approach where the decision-making experience coincides with the natural progression of a return-to-sport process. For example, an athlete may first need to be cleared by the team physician/surgeon, then the ATC, followed by the strength and conditioning coach and sports scientist, and finally the sports coach and athlete for each transition across the rehabilitation continuum [1].

In this sample, ATCs provided rationales for their rank order for influence on shared decision-making such as: "Surgeons and physicians ultimately make guidelines and decisions for student athletes. Everyone else down the list compliments the ATC that works with the program" (Respondent 50), "I don't work with a sports scientist, otherwise I might put this higher due to threshold values, activity transitions, etc. but I am unfamiliar with this process" (Respondent 61), and "When it comes to athlete's return to sport, the [athletic training] staff, sports performance staff, physicians and sport psychologists play the most important roles. Input from sports science, sports coach and nutrition play a secondary role" (Respondent 133). Many of the responses from ATCs support a siloed monodisciplinary decision-making approach [8]. It is well-documented that shared decision-making is complex in return to sport [3, 6, 9, 23, 29]. In order for a sports scientist to effectively collaborate in multidisciplinary decision-making, the sports scientist must facilitate effective knowledge translation [30]. Effective translation of evidence-based models into practice within elite sport settings will require frameworks and training models in workplace settings in order to translate this into a reality [2], especially given the findings in this study. With numerous professionals at the shared decision-making table, and the sports scientist ranked 11 out of 17, it will be imperative that the sports scientist appropriately and effectively translate information to partners in a meaningful way in order to continue efforts for inclusion on high-performance return-from-injury care teams [8, 30].

Several of the comments made by the respondents highlight an opportunity for improved education about the value of a sports scientist for NCAA member institution care teams within a multidisciplinary decision-making approach. These comments include statements made by Respondent 59 (see Table 2) and "Doctors and AT staff are at the top because we study the body and the protocols and how to best prepare them for sport" (Respondent 82). There will inherently be barriers to implementation, including access to resources, which was also identified by several survey respondents with comments such as: "This group is based on professional expertise and who we have on staff to participate" (Respondent 17). Increased education about the scope and roles can lead to improved understanding of the overlaps of care, which feeds more collaboration. This understanding may in turn increase motivation to effectively collaborate and support the role of the sports scientist. Ultimately, the current findings increase the amount of information available regarding care team structure and decision-making at NCAA member institutions to support the efforts for sports scientists to collaboratively work within interdisciplinary high-performance models.

This study is not without limitations. One primary limitation was the non-homogenous group sizes of professionals and divisions. Another limitation was that there may have been multiple respondents from the same university; the researchers did not ask the respondents for specific name of institution. Additionally, only one sports scientist, one nutritionist, one physical therapist, and two graduate assistant strength and conditioning coaches responded. These small sample sizes do not represent the professional group, and therefore, their data were not included. Furthermore, there was a wide range of the number of years in role, and a wide range

of exact professional title and credentials within each professional group, which may inherently impact the data. Another limitation of this study is the potential for coding errors or misinterpretation of statements from respondents. Errors with coding may have led to missing categories or mis-categorizing statements based on perceived context. Answers from respondents may have been influenced by their understanding of definitions used by authors (i.e., return to sport) and by word choice for specific titles (mental health provider titles) or models (interdisciplinary versus interprofessional). The selection of roles and professionals may have been influenced by a variety of factors including but not limited to an individual's understanding, past experiences, and a preferred care team size or structure. The findings of this current survey research highlight the need for additional research specific to the role of the sports scientist as part of an interdisciplinary NCAA member institution return-from-injury care team. A larger total sample size, with inclusion of representative samples of physical therapists, and nutritionists will provide a more robust sampling, allowing for additional statistical analysis and identification of trends. It may also be useful to have specific focus groups, across and within specific divisions, with more professional-specific research questions as follow-ups. Additionally, qualitative data and rank ordering was only gathered from the ATCs. Additional information may provide unique perspectives regarding perceptions, barriers, and opportunities within the return-from-injury care team. Data from the current study demonstrate a newfound need for multidisciplinary return-to-sports guidelines that accurately reflect current high-performance organizational models and the ideal decision-making setting described by professionals working at NCAA member institutions.

The integration of sports scientists into return-from-injury care teams presents a significant opportunity to enhance athlete performance and recovery outcomes. Data from the present study reveal a substantial gap between current care team structures and the ideal teams that professionals working at NCAA member institutions envision, with a notable underrepresentation of sports scientists across all divisions. Considering the sports scientists' expertise in data analysis and ability to disseminate this information practically, their inclusion on care teams could provide critical context into the readiness and long-term health of athletes returning to sport. To realize this potential, several actionable steps must be considered. Initially, the data presented within this manuscript clearly outline the lack of understanding of the value a sports scientist can provide, which suggests education about the role and benefits of sports scientists must be disseminated across NCAA institutions. Specifically, a vade mecum describing in detail how a sports scientist may integrate with NCAA care teams is needed. For example, a sports scientist can add context to a return-from-injury care team by providing data-driven insights on athlete workload management, conducting performance readiness assessments, analyzing injury risk factors, and offering evidence-based recommendations for rehabilitation progression. Furthermore, it is critical to develop and implement clear guidelines that outline the role of a sports scientist within care teams, facilitate smoother integration, promote collaboration, and ultimately enhance the effectiveness of return-from-injury protocols. In cases where employment of a full-time sports scientist is not feasible, frameworks can be implemented where strength and conditioning coaches or other existing staff with relevant expertise can partially fulfill the role of sports scientist. Partnership with a local academic sports scientist or private funding via a medical group could also take place. This approach allows for a scalable solution that accommodates varying levels of resources across NCAA divisions.

Conclusions

These findings fill known gaps regarding care team composition and decision-making across the NCAA. Care team composition varies between institutions, and until now, there have not been data published to indicate current care team composition trends. Data from the present study reveal a substantial gap between current care team composition and ideal care team composition, with a notable underrepresentation of sports scientists across all divisions. Results indicate that care team professionals working at NCAA member institutions would like to include a sports scientist on their ideal care team. However, the care coordinator in the NCAA setting is the ATC which means that the ATC would need to support this addition. Many responses provided by ATCs highlighted a monodisciplinary approach to care. As far as return-to-sport decision-making, ATCs ranked the sports scientist 11 out of 17. Therefore, if sports scientists were to be more commonly included on care teams in the future, moving towards the care teams envisioned, barriers such as using the current workplace model must be overcome to effectively integrate a sports scientist into decision-making, given their background and expertise. Despite the trends revealed in this study, the desire to add a sports scientist is not enough. Effective interdisciplinary collaboration must be sought due to the overlapping

scopes of professionals involved in return-from-injury care, and this manuscript provides practical applications to improve the integration of sports scientists.

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Conflict of Interest
The authors declare no conflict of interest.

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Appendix A

Survey

IRB Study Number: 2112583-1

Introduction

You are invited to participate in a research study. This study is being conducted by faculty in the School of Physical Therapy at Regis University. The purpose of this study is to identify perceptions of different athletics personnel about return from injury in NCAA sport. We want to understand who makes up these teams of professionals. We also want to understand what each person thinks their role is during different parts of the return from injury timeline. This includes what information is considered and who on the care team is best able to evaluate different parts of the rehabilitation process. Your participation is voluntary. This form includes detailed information on this research study to help you decide whether to participate or not. Please read it carefully and ask any questions you have before you agree to participate.

Procedures

Your participation involves completing one survey. This should take no more than 10 minutes. The survey has two parts. The first part will ask about your background. The second part will ask about return from injury experiences.

If you agree to participate, you will type your name as acknowledgement of this consent. No other personal data is needed.

The survey will be open from January 17th, 2024 to February 17th, 2024

Potential risks or discomforts

Your participation in this study does not involve any physical or emotional risk.

Possible benefits

Taking part in this research study may not benefit you personally. We may learn new things that may help others in the future. This may help athletes and return to performance decision making.

Confidentiality
The researchers will make every effort to ensure that the information you provide as part of this research remains confidential. Your identity will not be revealed.
We will only collect information via Qualtrics survey. This information will be securely stored in a password protected cloud-based storage system. It is only accessible to the primary investigators.
This form will be kept for a minimum of three years after the study is complete. Then it will be destroyed.
It is unlikely, but possible, that others (Regis University or State or Federal officials) may require us to share the information you give us from the study to ensure that the research was conducted safely and appropriately. We will only share your information if law or policy requires us to do so.

Financial Information
Participation in this study will involve no cost to you. You will not be paid for participating in this study.

What are my rights as a research participant?
Participation in this study is voluntary. You do not have to answer any question you do not want to answer. You may choose not to participate or to withdraw from this research at any time. If you decide not to participate or to withdraw from this study, please inform the researchers. The researchers may ask you if the information already collected from you can be included in the research project.

Who can I contact if I have questions or concerns about this research study?
If you have questions, you are free to email the researchers: Dr. Erin Choice at echoice@regis.edu and Dr. Rebecca Downey at downe809@regis.edu.
If you have any questions about your rights as a participant in this research, you can contact the following office at the Regis University:
Regis Institutional Review Board Regis University Denver, CO 80221, Phone: (303) 458-4188, e-mail: irb@regis.edu
Informed Consent
By typing your first and last name, you agree to participate in this study and are providing an electronic signature and verification that you are 18 years of age or older. By consenting, you indicate that you understand the risks and benefits of participation, and know what you will be asked to do. You also agree that you have asked any questions you might have, and are clear on how to stop your participation in the study if you choose to do so. Please email the researchers directly if you would like a copy of the informed consent for your records.

Demographics
1. What is your primary current professional role? (physical therapist, health athletic trainer, assistant athletic trainer, GA athletic trainer, head sports coach, assistant sports coach, physician, surgeon, health strength and conditioning coach, assistant strength and conditioning coach, GA strength and conditioning coach, sport scientist/ data analyst, nutritionist, registered dietician, mental performance coach, sport psychologist, other [text box]).
2. Who is your primary employer as it pertains to your work with NCAA athletes? (hospital/ system, university/ college, private clinic, corporately owned clinic, I am paid as part time status/ a part time employee or contractor directly from a university for my work with NCAA athletes, but this is not my primary employer, other [text box]).
3. What division do the majority of your collegiate athletes participate in? (NCAA Division I, NCAA Division II, NCAA Division III, other [text box]).
4. What conference(s) do the majority of your athletes play in?
5. How many years total have you worked with collegiate athletes in your professional role?
6. List top 3 sports you most commonly work with.
7. List any and all degrees and specialty certifications you have (for example DPT, MD, CSCS, Board certified specialty).

In the following questions, consider the following definitions:
Return to Participation: athlete may be continuing with rehabilitation, is beginning to train but at a lower level
Return to Sport: athlete may be playing their sport but is not participating at pre-injury level
Return to Performance: athlete has fully returned and is able to perform at or above pre-injury level
Second Domain of Questions
1. Who is part of your athlete's typical return from injury interprofessional team in your current workplace structure? (select all that apply) (physical therapist, head athletic trainer, assistance athletic trainer, head sport coach, assistant sport coach, GA sport coach, physician, surgeon, head strength and conditioning coach, assistant strength and conditioning coach, GA strength and conditioning coach, sport scientist/

data analyst, nutritionist, registered dietician, mental performance coach, sport psychologist, the athlete, other [text box]).

2. If you could create an optimal/ ideal care team for Return to Participation → Return to Sport → Return to Performance in NCAA sport, who would you include? (physical therapist, head athletic trainer, assistance athletic trainer, head sport coach, assistant sport coach, GA sport coach, physician, surgeon, head strength and conditioning coach, assistant strength and conditioning coach, GA strength and conditioning coach, sport scientist/ data analyst, nutritionist, registered dietician, mental performance coach, sport psychologist, the athlete, other [text box]).
3. Only for those who identified their professional role as athletic trainer: Rank order the other professionals on your care team from who you rely on the most (rank #1) to who you rely on the least (rank last) when it comes to Return to Sport decision making: (physical therapist, head athletic trainer, assistance athletic trainer, head sport coach, assistant sport coach, GA sport coach, physician, surgeon, head strength and conditioning coach, assistant strength and conditioning coach, GA strength and conditioning coach, sport scientist/ data analyst, nutritionist, registered dietician, mental performance coach, sport psychologist, the athlete, other [text box]).
4. Please briefly describe your rationale.

Additional survey questions that were not reported on in this manuscript can be requested by emailing the lead author