



Rebuilding The Elite: A Case Study On Collaborative Injury Rehabilitation In Division 1 Sports

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ABSTRACT

Purpose of the study: This study aims to explore the impact and effectiveness of a multidisciplinary approach in the injury rehabilitation of a Division 1 college athlete by combining medical, psychological, and performance perspectives.

Methodology: This study used a qualitative case study method involving interviews, observations, and document analysis. A multidisciplinary team, including a medical doctor, psychologist, and athletic trainer, collaborated using performance tracking tools and recovery protocols to support the athlete's rehabilitation.

Main Findings: The rehabilitation approach led to a faster and more holistic recovery, improved the athlete's psychological well-being, enhanced communication among professionals, and ensured return-to-play readiness. The collaborative model highlighted the importance of shared decision-making and athlete-centered care in optimizing injury rehabilitation outcomes.

Novelty/Originality of this study: This study presents an integrative model for injury rehabilitation that emphasizes team-based care in collegiate sports. It offers new insights into the collaborative dynamics and structured communication among health professionals, advancing knowledge on how holistic approaches can be implemented effectively in high-performance athletic environments.

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1. INTRODUCTION

Injury is a common and often inevitable part of sports participation, particularly at the collegiate level where athletes engage in high-intensity training and competition[1]-[3]. While traditional rehabilitation methods have typically focused on physical recovery alone, modern sports medicine recognizes that optimal rehabilitation should address not only physical, but also psychological and performance dimensions[4], [5]. This multidimensional view has led to the development of multidisciplinary approaches that bring together professionals from various fields to provide holistic care for injured athletes[6], [7].

Collegiate athletes, especially those competing at the Division 1 (D1) level, face unique pressures and demands that can significantly impact their recovery from injury[8]-[10]. These include academic obligations, scholarship requirements, and high expectations for athletic performance. Without proper support, injuries may lead to long-term physical issues, psychological distress, or even career termination. Therefore, there is an urgent

need for comprehensive rehabilitation models that account for these challenges and support the athlete in returning not only to play but to peak performance[11]-[13].

Previous research has emphasized the importance of collaborative care in sports rehabilitation[14], [15]. Studies have shown that including mental health professionals in injury recovery leads to better psychological outcomes, and that athlete-centered care models improve satisfaction and adherence to rehabilitation protocols. However, few studies have examined how these approaches are implemented in real-world collegiate settings and what outcomes they yield when applied cohesively in a multidisciplinary framework[16]-[18].

This study investigates a rehabilitation case involving a Division 1 college athlete who experienced a significant injury[19]-[21]. The approach employed integrates the expertise of a physician, a psychologist, and a performance coach in a coordinated care model. The innovation of this study lies in its application of a truly integrated rehabilitation model that not only prioritizes physical healing but also focuses on psychological readiness and performance optimization as part of the recovery journey[22]-[24]. The insights from this study aim to provide practical guidance for sports medicine teams, athletic trainers, and collegiate athletic programs on how to enhance rehabilitation outcomes through a team-based, athlete-centered approach[25], [26].

The study entitled “Cooperation between a physiotherapist and an occupational therapist in the rehabilitation process after cervical spine injury: a case study” focuses on collaboration between two health professions, namely physiotherapists and occupational therapists, in the rehabilitation process of cervical spine injuries. This study provides an important picture of professional synergy in the context of specific injuries and rehabilitation procedures that focus on the patient's daily functions and activities [27], [28]. However, the background of this study is still limited to cases of spinal injuries with a specific focus on clinical rehabilitation, without considering the context of competitive sports or more complex team dynamics. In contrast, the study “Rebuilding the Elite: A Case Study on Collaborative Injury Rehabilitation in Division 1 Sports” highlights injury rehabilitation in elite athletes at high levels of competition, where collaboration involves not only physiotherapists and occupational therapists, but also various other parties such as coaches, nutritionists, sports psychologists, and other medical staff [29]-[31]. The gap that emerges is the lack of exploration of a broader multidisciplinary collaboration model in a high-level competitive sports environment, which requires a holistic approach to accelerate athlete recovery and reintegration into peak performance. In addition, the aspect of injury management in the context of competitive pressure and high short-term performance demands has not been widely discussed in previous research. Therefore, there is a clear need for research that examines collaborative rehabilitation in a more comprehensive manner in the context of elite sport, with a focus on how different disciplines work together synergistically to address the specific challenges of competitive athletes [32]-[34]. This research should also consider the dynamics of inter-team communication, the adaptation of rehabilitation strategies to the specific conditions of the athlete, and the integration of psychological and social aspects that influence the recovery process. In this way, the Rebuilding the Elite study can fill an important gap in the literature regarding effective and contextual collaborative rehabilitation approaches for high-level athletes, who have different demands and needs than the general injured population [35]-[37].

This study presents a novelty by presenting a holistic, multidisciplinary collaborative approach to injury rehabilitation in elite athletes at the Division 1 competition level, which has so far rarely been studied in depth [38], [39]. Unlike previous studies that tend to focus on collaboration between two health professions in the context of a single clinical injury, this study explores the complex synergy between physiotherapists, occupational therapists, coaches, sports psychologists, and other medical personnel in an integrated rehabilitation team [40], [41]. Other novelties lie in the emphasis on communication dynamics, shared decision-making, and adaptation of rehabilitation strategies tailored to the pressures and demands of high performance in professional athletes. Thus, this study not only provides new insights into effective rehabilitation practices, but also offers an innovative collaboration model that can improve the recovery process and reintegration of athletes to peak competition levels more optimally and sustainably [42], [43].

This study has broad and important implications for the practice of injury rehabilitation in high-level competitive sport. By adopting a multidisciplinary collaborative approach involving physiotherapists, occupational therapists, coaches, sport psychologists and other medical personnel, this study paves the way for the development of a more integrated and comprehensive rehabilitation model [44],-[46]. This approach allows for the tailoring of rehabilitation strategies based on the individual needs of the athlete, accelerating physical recovery while maintaining psychological balance and mental readiness. The practical implications are that this collaborative model can improve the effectiveness of the rehabilitation process, reduce the risk of re-injury and accelerate the reintegration of athletes to competition at optimal performance, thereby making a real contribution to team success and the sustainability of elite athletes' careers [47], [48].

The urgency of this research is very high considering the complexity and pressure faced by elite athletes, especially at the Division 1 level which demands consistent peak performance in a limited time. Injuries in athletes at this level not only impact individual health, but also have the potential to disrupt the dynamics and results of the team as a whole [49], [50]. Unfortunately, many current rehabilitation approaches are still fragmented and lack attention to the cross-disciplinary synergy required in the context of competitive sport [51]-[53]. Therefore, this

research is very important to fill this gap by providing a deeper understanding of how effective collaboration between professionals can support optimal recovery, reduce time out due to injury, and maintain the sustainability of athlete performance in the long term [54], [55].

This study is unique in its multidisciplinary collaborative approach in the context of elite Division 1 athlete injury rehabilitation, which synergistically integrates multiple disciplines and professions to support optimal physical and mental recovery. Unlike previous studies that focused more on single clinical rehabilitation, this study highlights the complexity of competitive athletes' needs that demand a holistic and adaptive approach, while also taking into account the pressures of high performance and team dynamics. From the background that has been described, it can be concluded that there is an urgent need to develop an integrated rehabilitation model that is not only medically effective, but also able to accelerate the reintegration of athletes into the competitive arena in prime condition. Thus, this study makes an important contribution in expanding the understanding and practice of more innovative and contextual injury rehabilitation for the world of elite sport.

2. RESEARCH METHOD

This study adopted a quantitative descriptive method with a survey approach. The research was aimed at determining the effect of leadership style, work discipline, and work motivation on employee performance [56], [57]. The variables were measured using a Likert scale-based questionnaire. The research design followed a correlational model to identify relationships among variables and assess their influence using regression analysis.

The research was conducted through a series of systematic and structured steps to ensure data validity and reliability. The initial stage was the preparation phase, which began with an in-depth literature review to identify relevant theories and previous studies concerning leadership style, work discipline, work motivation, and employee performance [58]. This literature served as the foundation for formulating the research framework and hypotheses. Furthermore, variables were identified and operationalized by translating abstract concepts into measurable indicators that could be used in questionnaire items. This step was critical to ensuring the clarity and relevance of the research instruments to the context of tourism office employees in Bengkulu City.

The next phase of the research focused on developing and testing a reliable instrument to measure the study variables. A structured questionnaire was designed to assess three independent variables leadership style (X_1), work discipline (X_2), and work motivation (X_3) as well as the dependent variable employee performance (Y). Each variable was operationalized into 10 closed-ended statements, resulting in a total of 40 items

Table 1. Research Instrumen

Variable	Items	Scale Type	Example Item
Leadership Style (X_1)	10	Likert 1–5	“My supervisor communicates the vision of the organization clearly.”
Work Discipline (X_2)	10	Likert 1–5	“I consistently come to work on time.”
Work Motivation (X_3)	10	Likert 1–5	“I feel enthusiastic about achieving my work targets.”
Employee Performance (Y)	10	Likert 1–5	“I complete my tasks efficiently and effectively.”

Before full deployment, the instrument underwent validity testing using item-total correlation analysis in SPSS. This technique evaluates how well each item correlates with the overall score for its respective variable. Items that showed a correlation coefficient (r) below the acceptable threshold (typically $r < 0.30$) were considered for revision or removal. All retained items had satisfactory r -values indicating good construct validity.

Table 2. Item-Total Correlation for Leadership Style

Item Code	Corrected Item-Total Correlation	Valid (Yes/No)
$X_{1.1}$	0.56	Yes
$X_{1.2}$	0.49	Yes
$X_{1.3}$	0.27	No
$X_{1.4}$	0.62	Yes
$X_{1.5}$	0.45	Yes

To ensure internal consistency, **reliability testing** was conducted using **Cronbach's Alpha (α)** for each variable. Cronbach's Alpha measures how well the items in a set are positively correlated to one another, indicating internal consistency. A **Cronbach's Alpha value ≥ 0.70** was considered acceptable.

Tabel 3. Cronbach's Alpha Summary

Variable	Number of Items	Cronbach's Alpha (α)	Reliability Interpretation
Leadership Style (X_1)	9	0.84	Reliable
Work Discipline (X_2)	10	0.88	Highly Reliable
Work Motivation (X_3)	10	0.81	Reliable
Employee Performance (Y)	10	0.86	Reliable

The final stage involved data collection and analysis. Questionnaires were distributed to 60 respondents selected through total sampling, encompassing all available employees at the Dinas Pariwisata Kota Bengkulu who met the inclusion criteria. The collected data were coded and entered into SPSS version 25 for processing. Descriptive statistics were used to describe the profile of respondents and variable distributions. To test the proposed hypotheses, multiple linear regression analysis was conducted, aiming to determine the strength and significance of the influence of each independent variable on employee performance. This analytical approach allowed the researcher to identify which factors contributed most significantly to performance outcomes, thereby offering practical recommendations for organizational development.

3. RESULTS AND DISCUSSION

3.1. Demographics

Participants included 321 collegiate student-athletes representing 21 different NCAA Division I sports and 16 different conferences; 104 participants did not provide demographic information (e.g., sport, college conferences, gender, race). Given that approximately one-third of the participants did not complete the demographic questionnaire, there may be additional sports and conferences represented that were not fully documented in the analysis. The average age of participants completing the web-based questionnaire was 20.3 years old ($SD = 1.4$). Of College Athlete Perspective these participants, 69% ($n = 149$) self-identified as female, 29.6% ($n = 64$) as male, 0.9% ($n = 2$) preferred not to disclose their gender, and 0.5% ($n = 1$) identified as non-binary/third gender. Most of the sample identified as White or Caucasian (81.5%, $n = 176$). For a detailed breakdown of demographics, see Table 1.

Table 4. Demographic Information on the Participants Who Provided Their Information

Variabel	<i>n</i>	%	M	SD
Age	215		20.26	1.43
Ethnicity	216			
White/Caucasian	176	81.5		
Black or African American	15	6.9		
Asian/Pacific Islander	10	3.1		
Other	9	2.8		
Hispanic or Latino/a	5	2.3		
Prefer Not to Say	2	0.3		
Gender	216			
Female	149	69.0		
Male	64	29.6		
Prefer Not to Say	2	0.9		
Non-binary/Third Gender	1	0.5		
Injury Status	320			
Currently Completing Rehabilitation	178	55.6		
Previously Completed Rehabilitation	142	44.4		
Sport	213			
Track and Field	36	16.9		
Soccer	28	13.1		
Rowing	27	12.7		
Swim and Dive	22	10.3		
Baseball/Softball	19	8.9		
Cross Country	19	8.9		
Gymnastics	10	4.7		
Basketball	7	3.3		
Field hockey	7	3.3		
Volleyball	7	3.3		

Football	6	2.8
Lacrosse	5	2.3
Wrestling	4	1.9
Golf	3	1.4
Rugby	3	1.4
Equestrian	2	0.9
Fencing	2	0.9
Ice Hockey	2	0.9
Sailing	1	0.5
Tennis	1	0.5
Water Polo	1	0.5
Multiple Sport	1	0.5

Regarding rehabilitation status, 55.6% (n = 178) of participants were currently completing injury rehabilitation protocols at the time of data collection, whereas 44.4% (n = 142) reported previous completion of injury rehabilitation protocols. Using the Orchard Sport Injury and Illness Classification System (OSIICS; Rae & Orchard, 2007), respondents most commonly reported injuries to the lower limbs (e.g., knee, thigh, ankle; 54.7%; n = 173). In terms of injury severity, 72.6% (n = 233) reported severe injuries requiring over 4 weeks of rehabilitation, with the minority (27.4%; n = 88) reporting injuries requiring less than 4 weeks of rehabilitation. For detailed percentages of other injury locations and severities, see Table 2.

Tabel 5. Injury Descriptives of Participants

Variable	Injury Descriptives of Participants		Previously Completed Rehabilitation		Total	
	n	%	n	%	n	%
Injury Severity	178		143		321	
Severe	146	82.0	87	60.8	233	72.6
Moderate	22	12.4	37	25.9	59	18.4
Minor	10	5.6	19	13.3	29	9.0
Injury Location	177		139		316	
Lower Limb	90	50.8	83	59.7	173	54.7
Trunk	31	17.5	20	14.4	51	16.1
Upper Limb	26	14.7	20	14.4	46	14.6
Head	11	6.2	9	6.5	20	6.3
General	13	7.3	4	2.9	17	5.4
Unspecified	6	3.4	3	2.2	9	2.8

3.2. Primary and Secondary Team Categorizations

Among the primary care team, the most frequently identified members included athletic trainers (n = 264), athletic coaches (n = 106), strength and conditioning coaches (n = 92), and physicians/orthopedic surgeons (n = 92). For the secondary rehabilitation team, the most frequently identified members were athletic coaches (n = 112), strength and conditioning coaches (n = 105), and teammates (n = 104). For the visual representation corresponding to this data, consult Figure 1.

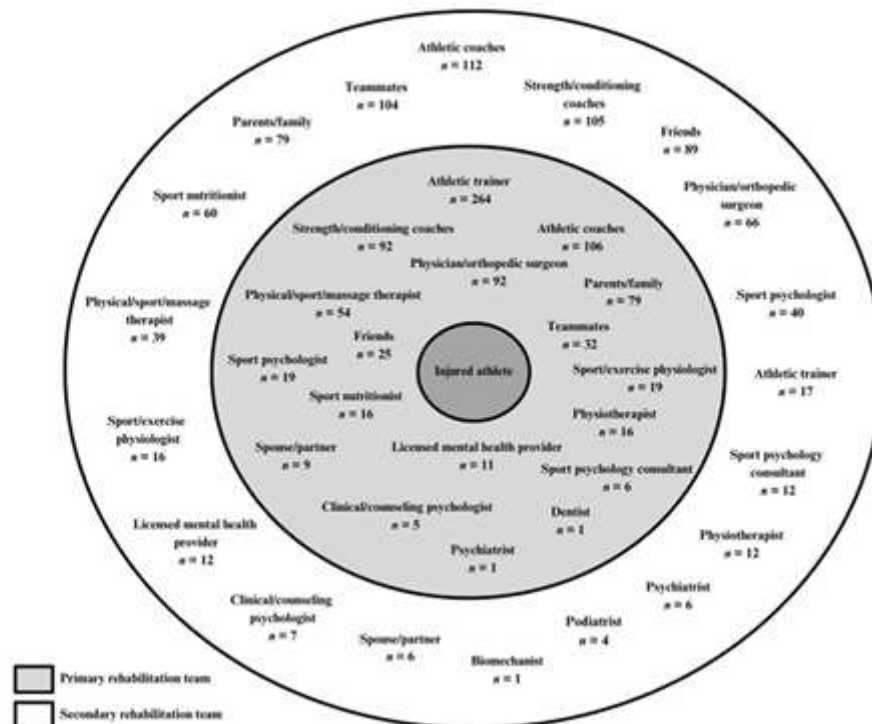


Figure 1. Frequencies of professionals/individuals identified as either the primary or secondary sport injury rehabilitation team.

Athletic coaches ($n = 106$) were the second most frequently reported professionals on the primary care team, but a higher percentage of participants (51.4%; $n = 112$) associated this profession with the secondary rehabilitation team. Similarly, strength and conditioning coaches College Athlete Perspective. were the third most identified members of the primary rehabilitation team ($n = 92$) but were more frequently placed on the secondary care team ($n = 105$). Mental health and mental performance professionals (i.e. psychiatrists, sport psychologists, clinical/counseling psychologists, sport psychology consultants, licensed mental health providers) were identified a total of 139 times as primary or secondary caregivers. Specifically, 20% of participants ($n = 82$) reported that a sport psychologist was involved in their injury rehabilitation process. Additionally, 8.8% of participants noted the involvement of licensed mental health providers, 6.6% identified sport psychology consultants, 5.6% identified clinical/counseling psychologists, and 2.5% identified psychiatrists as part of their rehabilitation team. Mental health and performance professionals were most frequently categorized as part of the secondary care team.

3.3. Perceptions of Social Support During Rehabilitation

Analysis of individuals involved in the injury recovery process revealed differences regarding frequency of identification and perceived support levels (see Table 3). A total of 320 participants initially indicated involvement of at least one professional provided on the randomized list. The most frequently identified professionals were athletic trainers, who received an average social support rating of 4.1 ($SD = 1.2$, $n = 312$). They were followed by athletic coaches ($M = 3.7$, $SD = 1.2$, $n = 240$), strength and conditioning coaches ($M = 4.3$, $SD = 0.96$, $n = 214$), and family/parents ($M = 4.7$, $SD = 0.6$, $n = 173$). Specifically pointing out mental health and mental performance professionals, based on rankings of ratings, licensed mental health providers received an average rating of 4.3 ($SD = 1.10$, $n = 28$), followed by clinical/counseling psychologists ($M = 4.2$, $SD = 1.30$, $n = 18$), sport College Athlete Perspective. psychologists ($M = 4.1$, $SD = 0.92$, $n = 64$), sport psychology consultants ($M = 4.1$, $SD = 1.10$, $n = 21$), and psychiatrists ($M = 4.1$, $SD = 1.20$, $n = 8$).

3.4. Effect of Sport Type and Rehabilitation Length on Social Support Perceptions

Sport type categorizations A 2x2 mixed analysis of variance was conducted to investigate differences in ratings of social support for rehabilitation care teams (primary vs. secondary) based on the classification of sport type as either team or individual sport. The results indicated no significant main effect on social support ratings for rehabilitation team levels, $F(1, 204) = 0.49$, $p = .488$. Additionally, there was a non-significant effect for the interaction of sport type on social support ratings for rehabilitation care teams, $F(2, 204) = 1.16$, $p = .315$. For a visual representation, see Figure 2.

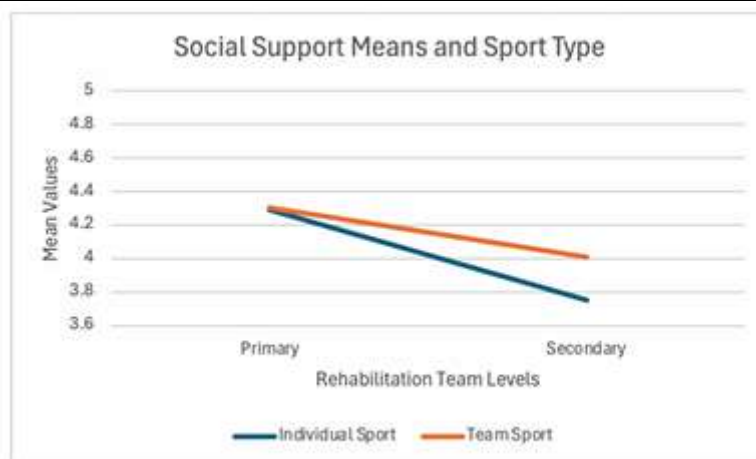


Figure 2. Social Support Means and Sport Type

Researchers conducted a second set of mixed-ANOVAs to explore differences in social support ratings for rehabilitation care teams based on rehabilitation length, which were grouped into two categories to maximize group size and power for the analysis. The first category included all athletes with less than or equal to 4 weeks of rehabilitation and the second group included athletes who reported over 4 weeks of rehabilitation. These 2x2 analyses were conducted separately in the sub-group of athletes currently completing rehabilitation and those who previously completed rehabilitation. Refer to Table 3 for a visual representation of the data.

Tabel 6. Identified Members of Injury Rehabilitation Process and Perceptions of Support

Individuals/Professionals	Identified as Involved in Rehabilitation Process		Social Support Ratings	
	n	%	M	SD
Athletic trainer	312	97.5	4.1	1.20
Athletic coaches	240	75.0	3.7	1.20
Strength and conditioning coach	214	66.9	4.3	0.96
Parents/Family	173	54.1	4.7	0.62
Teammates	148	46.3	4.1	0.96
Physician/Orthopedic surgeon	143	44.7	4.2	1.10
Friends	128	40.0	4.4	0.75
Physical/Sport/Massage therapist	107	33.4	4.2	1.00
Sport Nutritionist	82	25.6	4.0	1.00
Sport psychologist	64	20.0	4.1	0.92
Sport/Exercise physiologist	39	12.2	4.4	0.96
Physiotherapist	29	9.1	4.3	0.93
Licensed mental health provider	28	8.8	4.3	1.1
Sport psychology consultant	21	6.6	4.1	1.10
Clinical/counseling psychologist	18	5.6	4.2	1.30
Spouse/Partner	17	5.3	4.9	0.24
Psychiatrist	8	2.5	4.1	1.20
Podiatrist	4	1.3	4.3	0.96
Biomechanist	1	.003	3.0	
Dentist	1	.003	5.0	

Currently Rehabilitating Group. Results showed that among participants currently undergoing rehabilitation ($n = 157$), there was a significant main effect on social support perceptions between primary and secondary rehabilitation teams, $F(1, 155) = 8.99$, $p = .003$, $\eta^2 = .06$, indicating significantly higher ratings of social support for the primary care team ($M = 4.3$, $SD = 0.98$) compared to the secondary care team ($M = 3.8$, $SD = 1.1$), with a medium effect size. College Athlete Perspective. However, no significant effects were found for the interaction of rehabilitation length on perceptions of social support overall, $F(1, 155) = 1.33$, $p = .251$. Although not statistically significant, participants with rehabilitation lengths equal to or less than 4 weeks tended to rate the level of social support for the secondary care team higher ($M = 4.04$) than those with over 4 weeks of rehabilitation ($M = 3.77$). Refer to Figure 3 for a visual representation.

Previous Completion of Rehabilitation Group. There was another significant main effect on social support perceptions between primary and secondary rehabilitation teams, $F(1, 130) = 8.90$, $p = .003$, $\eta^2 = .06$, with a medium effect size. The interaction effect between rehabilitation length and level of social support ratings was not

significant $F(1, 130) = 0.82, p = .368$). Participants with over 4 weeks of rehabilitation ($M = 4.06$) rated the secondary team higher than those with equal to or less than 4 weeks of rehabilitation time ($M = 3.94$).

Thematic analysis procedures set forth by Braun and Clarke (2012) were conducted to investigate themes relevant to (a) participant distinctions between primary and secondary sources of support during injury rehabilitation, (b) identification of missing professionals, and (c) experiences working with either a SPC or LMHP. The researcher reviewed all participants' open ended responses to become familiar with the data before coding the data to identify recurring themes (identified below in italics).

Two primary themes emerged as criteria for categorical differences in participant decisions regarding the placement of individuals on either the primary or secondary rehabilitation care teams: the amount of contact time and support functions. Participants College Athlete Perspective, expressed that individuals were frequently placed on the secondary rehabilitation team due to a lack of consistent involvement compared to members of the primary rehabilitation team. One participant remarked, "The secondary support team, even though their support wasn't as frequent, was always beneficial when working with them." Secondly, participants more commonly reported receiving and seeking psychological and emotional support from the secondary team, whereas they predominantly looked to the primary team for physical support more specific to injury rehabilitation protocols. "The secondary team" were more the emotional/mental side and they kept me motivated," stated one participant. Conversely, about the primary team, one participant noted, "I felt that I was supported physically, but not mentally."

The most frequently identified missing service was mental support. The desire for the inclusion of mental support was mentioned a total of 33 times by participants, with several individuals named as potential providers of this support, including sport psychologists, mental health counselors, and psychiatrists. One participant stated, "If I had a sports psychologist, I feel this would help me get through mental blocks, depression, and anxiety." Other professionals that participants wished to include during rehabilitation were sport massage therapists ($n = 11$), either nutritionists or dieticians ($n = 7$), and chiropractors ($n = 4$).

Of participants who identified working with either a sport psychology consultant or a licensed mental health provider, which were the two professions added to the list by the researcher, two main themes emerged regarding experiences with these professionals: a safe space and support beyond sport[27]-[29]. Concerning a safe space, many participants described relief College Athlete Perspective, associated with the ability to express feelings and emotions about their injury to an individual not directly involved in their sport. One participant expressed, "It was the only place where I felt safe to break down because I was trying so hard to be strong." Indicative of support beyond sport, participants appeared to find comfort in talking with someone who discussed topics outside sport and injury[62], [63]. One participant described their experience, reporting, "He talked to me like I was more than just my athletics and checked in on other areas of my life." Despite these overarching themes, some participants indicated dissatisfaction with their experience working with these professionals. For instance, one participant stated, "I never received any coping techniques or ways to improve my mental state which was not very helpful."

According to data from over 300 collegiate student-athletes, these findings represent the first sample of student-athletes concerning their perspectives on, and perceptions of, multidisciplinary rehabilitation teams in the collegiate setting. In this sample, sport injury rehabilitation in the collegiate setting closely resembled the multidisciplinary model of sport injury rehabilitation, with all professionals from the original model accounted for by at least one participant in the present study[64], [65]. The current sample demonstrated the comprehensiveness of the individuals and professionals outlined in the multidisciplinary model. Despite the original model featuring ATCs and physicians/surgeons as the only primary team members, according to ATC and SPC viewpoints, student-athlete participants identified 16 additional roles they considered integral to the primary rehabilitation team. Notably, collegiate student-athletes more frequently reported athletic coaches as part of the primary rehabilitation team in comparison to the secondary team, similar to the experiences of former high school athletes. This difference in athlete perceptions highlights the significant role athletic coaches play in injury rehabilitation and suggests that coaches may be well-positioned to promote interprofessional approaches to injury rehabilitation. Additionally, it indicated that coaches' roles may align closely with those of ATCs, acting as directors of injury rehabilitation processes and coordinating the involvement of other professionals[66]-[68].

Differing from previous literature, the current sample identified strength and conditioning coaches more consistently on the primary rehabilitation team, at a frequency matching that of physicians/orthopedic surgeons. This finding is not only inconsistent with the model but also contradicts the perspective of ATCs and SPCs, who considered strength and conditioning coaches as essential secondary team members. However, this finding can be explained by the significant roles strength and conditioning coaches typically play in collegiate athletics, particularly in developing athletes' physical strengths[69]-[71]. Additionally, Eisner and colleagues (2014) found that both DI and DII athletes regard strength and conditioning coaches as vital to their development as athletes, with a significant positive correlation between the perceived importance of strength and conditioning and increased time spent in the weight room. Contrastingly, strength and conditioning coaches at the professional level have reported a limited role primarily toward the end of the rehabilitation process, despite recognizing the potential benefits of a more significant involvement. Barriers to earlier and increased involvement at the professional level

were related to relationships and communication among other members of the rehabilitation team that may not be present at the collegiate level.

Like the sample of former high school student-athletes, parents and family emerged as significant support providers for injured college athletes. While parents and family were equally represented across primary and secondary rehabilitation teams, spouses and partners were more frequently identified as primary rehabilitation team members, a finding not previously documented in related literature. Additionally, sport nutritionists were predominately assigned to the primary rehabilitation team, a finding also not previously reported in the literature. This finding contradicts the original model, and previous perspectives of ATCs, SPCs, and former high school athletes, all who typically considered these professionals as secondary rehabilitation team members. Importantly, the incorporation of a suitable and balanced nutrition plan into athletes' rehabilitation processes can be essential for mitigating inflammation and promoting physical healing, thus encouraging quicker recoveries. Similar to the finding with strength coaches appearing on the primary team, it is possible that some Division I athletes have consistent access to nutrition professionals and consider these services central to their recovery. Compared to athletes participating at the high school level, college athletes likely have much higher access to both strength coaches and nutrition professionals.

To explore potential interactions with mental performance and mental health professionals, this study expanded the list of professionals within the multidisciplinary team to include sport psychology consultants and licensed mental health providers. Approximately 15% of participants in the current study indicated the involvement of either an SPC or LMHP in their injury rehabilitation, with another 20% indicating sport psychologists, 5.6% indicating clinical or counseling psychologists, and 2.5% indicating a psychiatrist. A possible explanation for these seemingly high numbers could be attributed to the NCAA's attempts to support student-athlete mental health, such as the release of two documents to facilitate understanding and recommended best practices (NCAA, 2014; 2016). Per the release of "Mental Health Best Practices" in 2016, the NCAA required all institutions to have mental health services available for student-athletes. Data from the current study could serve to indicate that the NCAA mandates are having a positive impact on some athletes experiencing the emotional consequences of injury.

Thematic analysis revealed that participants primarily considered the consistency of interactions when categorizing team members, aligning with the model. Participants also highlighted the type of support as a main determinant. Most participants expected more direct support related to the physical aspects of their injury from primary team members and rated their satisfaction with this support higher than secondary team members. This finding corresponds with previous research indicating that athletes typically seek the most support from athletic trainers during the rehabilitation phase, particularly for both informational and emotional support. Participants relied more heavily on secondary team members for mental and emotional support, confirming distinct types of support received from rehabilitation team members. These novel qualitative findings can help researchers and practitioners more clearly understand athletes' perceptions of support during rehabilitation.

One explanation for higher support ratings of primary team members could be their frequent contact with participants and more instrumental role in physical healing. Previous researchers in the field of medicine found positive correlations between patient satisfaction ratings and the amount of time spent with physicians. Despite overall moderate to high perceptions of support, individual sport athletes and those undergoing rehabilitation lasting over four weeks reported lower mean ratings for social support. Whereas it may be logical to assume that participants with more severe injuries could perceive a decline in support throughout their lengthy rehabilitation, this finding contradicts previous research. Taylor and May (1995) found significantly higher levels of satisfaction among athletes experiencing more severe injuries requiring at least four weeks of rehabilitation. Conversely, the overall highest support for the primary team was reported by participants who had previously completed rehabilitation and had less severe injuries requiring less than four weeks of recovery. A potential explanation for the influence on perceptions of past support could be "rosy retrospective bias," where individuals tend to recall experiences more positively after they are over compared to during the experience. Additionally, it is possible that progress in rehabilitation is more tangible and measurable for the physical aspects of recovery than for the psychological components.

Interestingly, the highest rating for the secondary rehabilitation team was reported by participants who had previously completed rehabilitation and had been in protocols for over four weeks. Injury severity is a contributing factor to how an athlete perceives and responds to a sport injury and more severe injuries can contribute to more severe emotional responses. Thus, athletes with more severe injuries facing longer rehabilitation durations may rely more heavily on the secondary rehabilitation team than athletes with less severe injuries. This assertion is supported by data from the current participants who noted the most important functions of the secondary team as mental and emotional support. A further explanation could be that those requiring longer rehabilitation periods may just have had more time to have contact with secondary rehabilitation team members.

Even in Division I environments, participants highlighted the absence of certain professionals and services in their injury rehabilitation. Missing services and professionals included mental support from various providers, sport massage therapists, nutritionists or dietitians, and chiropractors. Participants also expressed a

desire for increased coach understanding and communication during injury recovery. Athletes commonly seek support from their coaches during injury rehabilitation, and the absence of this support can negatively impact their emotional responses to injury, potentially impeding the rehabilitation process.

The significance of communication, as highlighted in participants' open-ended responses, emphasizes its crucial role in effective interprofessional collaboration and athletes' perceptions of support. Consistent with the multidisciplinary team concept, ATCs typically serve as central communicators within the collegiate environment, coordinating between various professionals. Whereas multidisciplinary collaboration offers numerous benefits in injury rehabilitation, it also presents challenges, such as communication breakdowns, where stakeholders, including athletes, may not receive timely and adequate updates on injury and rehabilitation status. Although transdisciplinary team approaches represent the ideal for interprofessional collaboration, a more realistic shift for the collegiate injury rehabilitation environment would be towards interprofessional collaboration, first. This transition would foster greater collaboration among individuals involved in the injury rehabilitation process for treatment planning, aiming to alleviate communication stressors for injured athletes.

The mention of communication is key to the importance of this study and for future research to continue to explore. This study, along with previous research has provided support for the multidisciplinary model of injury rehabilitation for multiple sport contexts. However, it remains crucial for further research to investigate how multidisciplinary teams can operate more effectively, with communication a pivotal factor in this regard, and how potential shifts could be made towards a more interdisciplinary approach to injury rehabilitation within the collegiate environment. Subsequent studies should explore athlete viewpoints across diverse competition levels as athletic departments' financial resources can influence the care provided and thus the injury experience. To better understand potential aspects of change that could enhance the quality of injury rehabilitation care, future research should also consider a qualitative approach.

Whereas this study explored the first sample of collegiate student-athletes on their experiences with a multidisciplinary model of sport injury rehabilitation, several limitations persisted. One limitation is the low response rate of 5.7%, as only a small proportion of the targeted sample participated in the study. Low response rates can potentially lead to issues with generalizability, meaning the data may not be representative of all NCAA Division I athletes who have experienced an injury at their collegiate institution. Despite the NCAA reporting a response rate of 31% for NCAA Division I athletes in response to an emailed time demand survey when distributed by athletic directors and coaches (NCAA, 2016), the present study represents one of the largest datasets on Division I college athletes' perceptions of social support amongst interprofessional rehabilitation team collaboration relative to injury recovery. Another limitation is the cross-sectional nature of this study as this data is only representative of student athlete perceptions at a single time point, limiting the ability to establish causal relationships between variables. Further research should look to assess changes over time from the onset of injury through return-to-sport phases of injury recovery. There may also be recall bias present in the study for those participants who had previously completed rehabilitation, which could affect accurate depictions of recollections of their experience.

The study entitled "Reinforcement learning in treatment pathway optimization: A case study in oncology" highlights the use of artificial intelligence technology, specifically reinforcement learning, to optimize cancer patient treatment pathways. The results of this study demonstrate the great potential of machine learning algorithms in dynamically identifying and adjusting medical interventions based on continuously updated patient data, resulting in more personalized and effective treatment decisions. However, the focus of this study is limited to the clinical realm of oncology with a highly structured technology-based approach, without considering the context of human team collaboration and psychosocial factors that also affect patient recovery outcomes. In contrast, the study "Rebuilding the Elite: A Case Study on Collaborative Injury Rehabilitation in Division 1 Sports" focuses more on the aspect of multidisciplinary collaboration between professionals in elite athlete injury rehabilitation. The results of this study emphasize the importance of communication, coordination, and synergy between various roles such as physiotherapists, coaches, sports psychologists, and medical personnel in creating an adaptive and holistic rehabilitation plan. The main gap that emerged was the lack of integration of advanced technologies such as reinforcement learning in the sports rehabilitation process to support clinical decision-making and rehabilitation strategies in real-time, so it still relies on experience and manual communication between teams. Thus, there is a great opportunity to bridge the gap between technology-based approaches and human collaboration in athlete injury rehabilitation. Further research can develop models that integrate reinforcement learning with multidisciplinary collaborative practices to optimize rehabilitation pathways that are not only based on clinical data, but also consider team dynamics and the psychosocial conditions of athletes. This hybrid approach is expected to increase the effectiveness of interventions, accelerate recovery, and support more responsive decision-making in the context of competitive sports that demand maximum performance.

This study presents significant novelty by combining a multidisciplinary collaborative approach in elite athlete injury rehabilitation with the potential application of advanced technologies such as reinforcement learning to support real-time clinical decision-making. Based on the findings, this study not only highlights the importance of synergy and interprofessional communication in the rehabilitation team, but also opens up room for innovation through the integration of machine learning algorithms that can personalize the rehabilitation pathway according

to the athlete's individual response and needs dynamically. This novelty lies in the combination of humanistic aspects including team coordination and attention to psychosocial conditions—with artificial intelligence that is able to optimize intervention strategies adaptively, thus providing a rehabilitation model that is more effective, efficient, and responsive to the high-performance demands of competitive sports. Thus, this study contributes to the development of a modern rehabilitation paradigm that combines the advantages of technology and a multidisciplinary approach for optimal recovery outcomes.

Based on the results and findings of the study, the implications generated are very important for the development of injury rehabilitation practices in elite sport environments. A multidisciplinary collaborative approach integrated with reinforcement learning technology can revolutionize the way medical teams and coaches design and adjust rehabilitation programs in real-time, thereby increasing the accuracy and effectiveness of interventions. This will not only accelerate the physical and mental recovery process of athletes, but also reduce the risk of re-injury and increase performance readiness in high-level competitions. The practical implications are the availability of a more adaptive, data-driven and personalized rehabilitation model, which can become a new reference in the management of professional athlete injuries and strengthen interprofessional collaboration in rehabilitation teams, thereby supporting the sustainability of athlete careers and the success of the team as a whole.

The results and findings of this study still have limitations that need to be considered in their interpretation and application. First, this study is a single case study with a focus on one team or individual athlete in a Division 1 environment, so the generalization of the results to a wider athlete population is limited. In addition, the integration of reinforcement learning technology in the context of collaborative rehabilitation is still in its early stages, so it has not fully explored complex variables such as psychosocial factors, team dynamics, and individual variations in response to intervention. The limited longitudinal data also hampers the analysis of the long-term impact of this approach on rehabilitation success and recurrent injury prevention. Therefore, further research with a larger sample size, longer observation duration, and the development of more mature and integrated algorithms is needed to overcome these limitations and strengthen the validity of the findings.

4. CONCLUSION

Injured collegiate student-athletes interact with many individuals throughout their rehabilitation, with ATCs remaining in a crucial “director” role. College athletes were moderately to highly satisfied with all stakeholders and overall rehabilitation teams. Additionally, the study revealed some nuances within the collegiate environment compared to previous research, which is crucial for understanding how improvements can be made to the rehabilitation process for better care of injured athletes. In general, a significant number of injured student-athletes interacted with either a mental performance or a mental health professional, indicating their access to these resources throughout the rehabilitation process. Moreover, there was a notable level of interest among those who were not currently working with these professionals, suggesting a desire for these services. Future investigation needs to gain a more comprehensive understanding of the workings of multidisciplinary approaches to injury rehabilitation in the collegiate setting so that rehabilitation programs can be optimized to promote physical and emotional recovery from injury.

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