EXPLORING SPORT-RELATED CONCUSSION GUIDELINES AND MEDICAL MANAGEMENT APPROACHES

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I - Thesis Summary

Sport-related concussion (SRC) remains a complex and evolving challenge in both clinical and sporting environments, with persistent inconsistencies in how it is defined, managed, and implemented across different contexts. While efforts have been made to improve awareness and standardise care, gaps continue to exist between policy and real-world practice, particularly in elite sport. This thesis investigates those gaps through two complementary research projects: a PRISMA-based scoping review and a qualitative interview study.

The scoping review systematically mapped existing SRC policies, protocols, and guidelines across a wide range of sports and international contexts. Findings revealed inconsistency in return-to-play (RTP) criteria, sideline evaluation practices, and audience targeting, with many organisations relying on generic or outdated frameworks rather than sport-specific policies. The second study involved qualitative interviews with six medical professionals, comprising four physiotherapists and two sports therapists, working in high-performance sport. Participants described SRC as an invisible, evolving injury and highlighted the challenge of applying rigid guidelines to dynamic, high-pressure sporting contexts. Their experiences revealed a spectrum of confidence and interpretation in SRC care, shaped by individual training, exposure, and clinical reasoning. Notably, practitioners expressed a desire for clearer guidance that still allowed for flexibility and athlete-centred decision-making. Together, these two studies provide a layered understanding of SRC governance and application, underscoring the urgent need for policies that are not only evidence-informed but also practically viable. By examining both the structural frameworks and practitioner perspectives, this thesis contributes meaningful insight into the alignment of policy with the realities of concussion care in elite sport.

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List of abbreviations

Abbreviation	Full Term
AAN	American academy of neurology
ACC	Accident Compensation Corporation (NZ)
ACE	Acute Concussion Evaluation
ACRM	American Congress of Rehabilitation Medicine
ACSM	American College of Sports Medicine
ADL	Activities of Daily Living
AFL	Australian Football League
AJA	Australian Jockeys' Association
AMS	Altered Mental Status
AMSSM	American Medical Society for Sports Medicine
ARP	Association of Ringside Physicians
ARU	Australian Rugby Union
AT	Athletic Trainers
ATC SPOTTERS	Booth Certified Athletic Trainer Spotter
BA	Basketball Australia
BC	British Cycling
BCTT	Buffalo Concussion Treadmill Test
BESS	Balance Error Scoring System
BIST	Brain Injury Screening Tool
CA	Cricket Australia
CAMS	Confederation of Australia Motorsport
CCA	Canadian Chiropractic Association
CCGI	Canadian Chiropractic Guideline Initiative
CHR	Crown of the Helmet Rule
CISG	Concussion in Sport Group
CMO	Chief Medical Officer
COGSPORT	CogSport Concussion test
COPSI NETWORK	The Canadian Olympic and Paralympic Sport Institute Network
CRT5	Pocket Concussion Recognition Tool 5th Edition
CRT6	Concussion Recognition Tool-6th Edition
CS	Cervical Spine
CT	Computed Tomography Scan
CTE	Chronic Traumatic Encephalopathy
DFL	Deutscher Fußball-Bund
DHI	Downhill Mountain Biking
DTI	Diffusion Tensor Imaging
EAP	Emergency Action Plans
ECB	England and Wales Cricket Board
EMS	Emergency Medical Services
ESNZ	Equestrian Sports New Zealand
FEI	The Fédération Equestre Internationale
FFA	Football Federation Australia
FIA	Fédération Internationale de l'Automobile
FIBA	The International Basketball Federation
FIFA	Federation Internationale De Football Association

FMRI	Functional Magnetic Resonance Imaging
GBCT	Great Britain Cycling Team
GCS	Glasgow Coma Scale
GRFP	Graduated Return to Football Programme
GRTP	Graduated Return to Play
GRTS	Graduated Return to Sport Protocol
HCP	Health Care Professional
HCPC	Health and Care Professions Council
HIA	Head Injury Assessment
HIT	Head Impact Telemetry
HITS	Head Impact Telemetry System
HN&S	(NFL) Head, Neck, and Spine Committee
HR	Heart Rate
ICC	International Cricket Council
ICCS	International Conference on Concussion in Sport
IIHF	International Ice Hockey Federation
IMPACT	Immediate Post-Concussion Assessment and Cognitive Testing
INC	Independent Neurologic Consultant
IOC	International Olympic Committee
KD TEST	King-Devick Test
KO	Knock Out
LOC	Loss of Consciousness
MBESS	Modified Balance Error Scoring System
MDD	Match Day Doctor
MLB	Major League Baseball
MLS	Major League Soccer
MMA	Mixed Martial Arts
MOI	Mechanism of Injury
MP	Medical Professional
MRI	Magnetic Resonance Imaging
MTBI	Mild Traumatic Brain Injury
NATA	National Athletic Trainers Association
NBA	National Basketball Association
NCAA	National Collegiate Athletic Association
NFL	National Football League
NFLPA	National Football League Players Association
NHL	National Hockey League
NHLPA	National Hockey League Players Association
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NMT	Neuromuscular training
NOCSAE	The National Operating Committee on Standards for Athletic Equipment
NRL	Australian National Rugby League
PA	Physical Activity
PCE	Potential Concussive Event
PCS	Post-Concussion Syndrome
PCSS	Post-Concussion Symptom Scale
PPCS	Persistent post-concussion symptoms

PRISMA-SCR	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
PSA	Pitch Side Assessment
PSASRC	Persistent Symptoms after SRC
PTA	Post-Traumatic Amnesia
RCCSSC	Royal College of Chiropractic Sport Sciences Canada
RIDE-DHI	The Roadside Head Injury Assessment for Road Cycling
RFU	Rugby Football Union (England)
RTL	Return to Learn
RTP	Return to Play
RTS	Return to Sport
SAC	Standardised Assessment of Concussion
SCAT	Sport Concussion Assessment Tool
SCAT3	Sport Concussion Assessment Tool – 3rd Edition
SCAT5	Sport Concussion Assessment Tool – 5th Edition
SCAT6	Sport Concussion Assessment Tool – 6th Edition
SCOAT6	Sport Concussion Office Assessment Tool - 6th Edition
SIS	Second Impact Syndrome
SRC	Sports-Related Concussion
TA	Thematic Analysis
TBI	Traumatic Brain Injury
TEMP-A	Template Analysis
THEM-A	Thematic Analysis
TKO	Technical Knock-Out
TPCC	Team Physician Consensus Conference
UFC	Ultimate Fighting Championship
UNC	Unaffiliated Neurotrauma Consultants
VOMS	Vestibular Oculomotor Motor Screening Assessment
WAKO	World Association of Kickboxing Organisations
WHO	World Health Organisation
WR	World Rugby
5RS	Rest, Recovery, Rehabilitation, Refer, and Return-to-Play (RTP) of SCAT
8RS	Recognize, Remove, Record, Refer, Rest, Recover, Record, Return to Play
11RS	Recognise, Reduce, Remove, Refer, Re-evaluate, Rest, Rehabilitate, Recover, Return-to-Learn/Return-to-Sport, Reconsider, and Residual Effects
12RS	Recognise, Reduce, Remove, Refer, Re-evaluate, Rest, Rehabilitate, Recover, Return-to-Learn/Return-to-Sport, Reconsider, Retire, Refine

CHAPTER ONE: Sport-Related Concussions: Setting the Stage for Analysis

Section 1 - Background and Content

1.1 Background

1.1.1 What is a Sport-related Concussion?

Sport-related concussion (SRC) is classified as a traumatic brain injury (TBI) caused by impulsive forces transmitted to the brain through impacts to the head, neck, or body during sports and exercise activities (1). These injuries result from various force types, inclusive of linear, translational, and rotational forces contributing to head injury that elicits the potential of both acute and prolonged symptoms (1, 2). Standard neuroimaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI), typically do not reveal structural abnormalities, yet advanced research imaging may detect functional or metabolic disruptions (1-4). SRC is a highly heterogeneous phenomenon due to the dynamic mechanisms of injury and wide magnitude of symptoms brought forth by it, both in terms of range and severity (5, 6). Symptoms are highly variable and can affect cognition, mood, vision, balance, or sleep, often evolving or persisting beyond initial injury, highlighting the heterogeneous nature of this condition (5, 6). The prevalence and significant long-term health impacts of SRC underscore the need for effective diagnosis and management strategies.

Globally, the prevalence of SRC has become a growing concern across all levels of sport. In the United States alone, it is estimated that approximately 3.8 million SRCs occur annually, a figure that continues to rise due to increasing sports participation and improved recognition of concussion cases (7). While SRC can happen in virtually any sport, the risk is significantly elevated in those including frequent contact and high potential for collision.

Over a four year period, SRC rates in National Collegiate Athletic Association (NCAA) athletes were highest in men's wrestling (0.89 per 1000 athlete-exposures), women's ice hockey (0.78), and men's football (0.75), highlighting the risk burden in these environments (8). Mismanagement or delayed diagnosis of SRC can lead to prolonged symptoms, repeat injury, and, in rare cases, catastrophic outcomes such as second impact syndrome (SIS) (9). Repeated concussions have also been associated with long-term neurocognitive impairments and, in select cases, increased risk of neurodegenerative disease such as chronic traumatic encephalopathy (CTE)(10). These risks underscore the need for early, accurate identification and standardized, evidence-informed care. Addressing these challenges requires accurate diagnosis, effective management, and the development of sport-specific prevention strategies.

The individualised nature of SRC injury also necessitates a tailored approach to management that target the myriad of symptoms and subsequent variances within injury and recovery (5). Effective management not only protects acute athlete health and performance but also reduces broader health risks. Nevertheless, the presence of diverse SRC consensus statements paired with the influence of organisational and professional biases complicates the field (11). Such inconsistencies of SRC policy, guidelines, and protocols increases the risk of prolonged symptoms due to delayed or inadequate care. Proper early clinical interventions and diagnosis are key to reducing such risks (12, 13). Given the variability in individual responses to concussion, more detailed and inclusive research is essential to advance tailored and equitable SRC prevention and care strategies.

While various terms appear across the literature, such as "concussion", "mild traumatic brain injury" (mTBI), or "TBI", this thesis adopts "sport-related concussion" (SRC) to reflect both the clinical and contextual focus of the project. Alternative terms may appear

in the source materials, reflecting the ongoing lack of universal consensus on nomenclature. The use of SRC ensures clarity and consistency in the context of this work, while acknowledging the diversity of language across research. The use of this term aligns with current guidance, including the 6th *International Consensus Statement on Concussion in Sport* from the Concussion in Sport Group (CISG), which presents an updated definition of SRC and revised tools such as SCAT6 and SCOAT6 (1). This document includes updates on previous consensus statements, an updated conceptual definition of SRC, revised clinical assessment tools, and new recommendations for para-athletes, ethical considerations, and return-to-learn/sport pathways. Although CISG's work is widely cited and influential in shaping sport policy, its recommendations are not consistently enforced or uniformly applied across sporting contexts. This thesis uses 'SRC' consistently to provide clarity and coherence. For a broader overview of evolving SRC definitions and their application, see Patricios et al. (2023) and Silverberg et al. (2023) (1, 4).

1.2 Importance of Research

As a condition that can compromise both short-term athletic performance and long-term health, SRC remains a pressing concern in both high-performance and medical communities. Despite increased recognition of SRC as a priority issue across elite sport contexts, there remains no universal agreement on how the condition should be diagnosed, managed, or monitored, particularly across sports, nations, and varying governing bodies (14). This inconsistency contributes to variable care and poses risks to athletic health, particularly in environments where time, pressure, and performance expectations can complicate clinical decision-making. In environments where performance expectations are high and time pressures are intense, such variability can lead to premature RTP, persistent symptoms, or severe complications such as SIS, a condition associated with rapid cerebral

swelling and potentially fatal consequences when a second head injury occurs before full recovery from an initial SRC (15). Even in leagues that have established SRC guidelines, real-world adherence remains inconsistent. Barriers such as limited education, poor dissemination of protocols, and variable implementation by stakeholders and healthcare professionals (HCP) contribute to this gap between policy and practice (16). When decision-making is poorly enforced, these gaps can compromise athlete safety and prolong recovery timelines. Research in this area is urgently needed to bridge the gap between guideline development and real-world practice. By examining both the content of SRC guidance and the lived experiences of the HCPs expected to apply it, this dissertation contributes to ongoing efforts to strengthen SRC care systems and promote safer, more consistent management across sporting environments.

1.3 Research Approach

1.3.1 Research Paradigm

SRC is a condition that exists at the intersection of clinical practice, sport culture, and individual variability. Accordingly, this dissertation is grounded in a pragmatist research paradigm, which prioritizes the research problem and inquires through flexible methods without allegiance to a single epistemological position (17). Pragmatism supports methodological flexibility and recognises that knowledge is shaped through both evidence and experience, making it well-suited for the challenges of SRC, which involves intersections between medicine, policy, athlete care, and sport culture (17). This paradigm supports the integration of both structured evidence synthesis and lived professional experiences, making it particularly suitable for the dual-method design of this thesis: a scoping review to map and evaluate the breadth of SRC-related evidence, and a qualitative study to explore how medical professionals navigate these protocols in high-performance sport contexts. Pragmatism

supports the use of multiple forms of data and accepts that truth is constructed through inquiry (17). Pragmatism was adopted as the overarching orientation to support the dual-method design of this thesis. This lens aligns with the objectives of this dissertation, to assess both what is formally stated in SRC guidance and how such guidance is experienced and implemented by practitioners.

The scoping review aimed to systematically map and evaluate SRC policies, protocols, and guidelines across sports, requiring comparison, categorisation, and synthesis across heterogenous sources. This evidence mapping was oriented towards identifying patterns, isolating gaps, and looking at areas of convergence to inform practice, rather than interpreting the meaning behind individual sources. Interpretivist paradigms, by contrast, prioritise subjective meaning, contextual specificity, and the co-construction of knowledge between researcher and participant (18). Interpretivist inquiry is typically oriented towards a depth of understandings, rather than produce comparative claims and summarising evidence (19). As such, a wholly interpretivist positioning would have been misaligned with the aims of the scoping review, which required synthesis across a broad body of evidence.

Although the qualitative interview component of this thesis adopted a reflexive interpretivist stance, consistent with reflexive thematic analysis, the dissertation as a whole was not positioned as strictly interpretivist. Reflexivity here refers to the process by which the researcher continually reflects on their role in the research, including how personal experiences, biases, and disciplinary background shape data interpretation (20). While a fuller discussion of reflexivity and researcher positionality is provided in Chapter Three, it is important to acknowledge here that the qualitative study involved active engagement with the data, requiring awareness of the researcher's influence throughout the analytic process.

Interpretivism was therefore applied purposefully within the qualitative component, which integrated practitioner perspectives, reflexivity, and researcher positionality in order to explore how SRC guidance is understood and applied in practice (21).

Reflexivity was embedded throughout, acknowledging how the researcher's background, disciplinary training, and positionality shaped data interpretation (22). The main researcher entered this project as a novice qualitative researcher, with academic training in kinesiology and sociology. This positionality offered both benefits and limitations, affording familiarity with the language and context of SRC while requiring heightened awareness of potential bias and interpretive influence. Deliberate reflection and methodological rigour were prioritised to balance this insider-informed yet methodologically novice position. Pragmatism provided a coherent framework through which these distinct components could be aligned without forcing one paradigm, allowing each to address its specific study aim while contributing to a unified, applied understanding of SRC. This approach reflects the view that research paradigms should be selected based on the nature and purpose of the inquiry, enabling both structured evidence synthesis and interpretive depth within one integrated dissertation (18). Together, these methodological considerations reflect the dissertation's commitment to producing findings that are both theoretically grounded and practically applicable within the evolving landscape of SRC care.

1.3.2 Conceptual Framework: Knowledge-to-Action

To further support the applied focus of this dissertation, the Knowledge-to-Action (KTA) framework was used as a dynamic conceptual lens to understand the relationship between the development of SRC guidance and how it is implemented in practice. Knowledge translation broadly refers to the process through which evidence-based

knowledge is transferred, interpreted, and applied within real-world settings, and the KTA framework provides a structured way of conceptualising this process by distinguishing between knowledge creation and action (23, 24).

In this dissertation, the scoping review aligns with the knowledge creation component of the KTA framework by mapping and evaluating the content, scope, and characteristics of SRC policies, protocols, and guidelines (25). The qualitative interview study then engages with a portion of the action cycle, exploring how medical professionals interpret and apply this guidance. This framework is revisited later to support interpretation and synthesis of findings.

1.4 Project Summaries

1.4.1 Scoping Review

The first component of this dissertation involves a scoping review designed to examine the breadth, contents, and variability of existing SRC policies, protocols, and guidelines across national and international contexts. The review followed the guidelines in the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) and included 115 total documents across 22 sports. Documents were analysed using template analysis (TEMP-A), with coding focused on the presence or absence of key concussion management domains. These included purpose and scope, prevention strategies, sideline evaluation and diagnosis, RTP protocols, and follow-up care. The analysis highlighted inconsistencies in SRC definitions, audience targets, implementation procedures, and post-injury care. Findings revealed that while many pieces of evidence referenced consensus statements, such as those produced by the Concussion in Sport Group (CISG), their application in practice varied. Findings from the PRISMA-ScR

contributed and summarised broad information towards the understanding of how SRC guidance is framed across sporting bodies.

1.4.2 Qualitative Interviews

The second component of this dissertation explores the real-world practices of HCP involved in the management of SRC, with a focus on their approaches and attitudes surrounding diagnosis, treatment, and RTP decision-making. Using qualitative methods, including semi-structured interviews, this research investigated how HCP engage with existing protocols, how their environment may influence practice, and what barriers they encounter within SRC care. The study also explored perceptions of authority and confidence regarding SRC information, revealing areas of both certainty and difficulty in concussion care. By analysing these narratives through reflexive thematic analysis (THEM-A), this project illuminated how SRC management unfolds at the practitioner level, often in ways that reflect challenges reviewed in the scoping review portion of this dissertation. This inquiry provided essential context for understanding how knowledge translation and gaps in education impact day-to-day clinical SRC decision-making.

1.4.3 Linking Evidence and Experience: The Relationship Between Both Studies

The two components of this dissertation were intentionally structured to offer complementary perspectives on SRC management. The scoping review provided a comprehensive overview of the existing SRC guidance and information, its structure, and identified gaps across diverse pieces of evidence. In contrast, the qualitative interview study offered insight into how HCP interpret, navigate, and apply those same forms of guidance in sporting contexts. Together, these studies capture both the content available within SRC protocols and the practitioner reality of concussion care. This dissertation draws conceptually

from the biopsychosocial model, which offers a useful framework for understanding concussion as a condition shaped by biological, psychological, and social factors (26). This perspective supports the integrated, athlete-centred analysis developed across both studies. Ultimately, this dissertation examines the disconnect between SRC policy and practice by analysing the structure of existing guidelines and the lived experiences of medical professionals managing SRC in high-performance sports.

CHAPTER TWO: Sport-Related Concussion Policy, Protocols, and Suggested Guidelines: A PRISMA Scoping Review

Abstract

Introduction: SRC is a prevalent injury with potentially serious health consequences, including persistent symptoms and long-term cognitive impairment. Despite increased attention, global inconsistencies persist in SRC definitions, assessment protocols, and management strategies, particularly across sports, nations, and governing bodies. These variations hinder implementation and create risks for mismanagement. This review addressed this challenge by evaluating the scope and consistency of current SRC guidance.

Objective: This review aimed to map the breadth of existing SRC policies, protocols, and guidelines, identifying core components, points of variation, and opportunities for improved standardisation in SRC management across sport contexts.

Inclusion Criteria: This review includes studies and guidelines that focus on SRC protocols, policies, and management guidelines across various contact and combat sports and geographic locations. Both peer-reviewed academic studies and high-quality grey literature were considered. Only the most recent, publicly available evidence published within the last ten years was included.

Methods: A scoping review following the guidelines in the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). A comprehensive search was conducted across multiple databases, including PubMed, Web of Science, SPORTDiscuss, and others. Grey literature sources were obtained through Google Scholar, Overton, and advanced Google searches. The preliminary search was completed on October 15th. The final search was completed October 30th, 2024. Data were coded using template analysis.

Results: A total of 115 sources across 22 sports were included. Considerable variation was identified across six key domains: SRC definitions, preventative measures, sideline evaluation, RTP protocols, follow-up care, and document purpose. While many sources referenced the CISG, the degree to which these recommendations were adopted varied. Guidelines frequently lacked clarity around target audience, implementation procedures, and compliance mechanisms.

Conclusions: Findings revealed discrepancies in definitions, RTP procedures, and the translation of guidance into practice, with many sources lacking sport-specific clarity. While references to the CISG were common, standardisation across settings or sports remains limited. These results underscore the need for clearer, more consistent, and context-sensitive SRC frameworks and highlight key priorities for future research, policy development, and guideline dissemination.

Keywords*:* Sport-related Concussions, Guidelines, Management, Diagnosis, Return-to-Play

Section 2 - Introduction

2.1 Introduction and Rationale

The lack of a universally accepted definition of SRC underscores the need for a comprehensive understanding of the highly individual nature of the injury (27). Sharp & Jenkins (2015) argue that the term *concussion* lacks diagnostic precision and promotes a "lazy diagnostic approach," leading to "uninterpretable science, poor clinical guidelines and confused policy" (28). They propose that the term be retired in favour of more pathophysiological grounded language (28). Given the continued reliance on variable terminology across sporting bodies and healthcare systems, there is a pressing need to consolidate and clarify how SRC is discussed and implemented in practice. This scoping review aims to fill these gaps by systematically mapping existing policies, protocols, and guidelines for SRC management. The resulting synthesis seeks to inform clearer diagnostic and management practices, thereby supporting athlete safety and enabling more consistent, evidence-informed care strategies. The following research question was formulated: *What is the current state of sport-related concussion policies, protocols, and guidelines?*

2.2 Objective of the Review

The primary objective of this PRISMA-ScR was to systematically identify, evaluate, and synthesize existing academic and grey literature on SRC policies, protocols, and suggested guidelines (29). By examining the breadth of current practices and recommendations across athletics and sporting contexts, this review aimed to understand the diversity and effectiveness of concussion management strategies. It explored which protocols are most widely implemented and recognised, the variations in policy, and the gaps in current

guidelines. Through this process, the review sought to clarify which commonalities exist amongst guidelines and where discrepancies were most apparent.

Section 3 - Methods

3.1 Protocol Design

To comprehensively review all existing literature on this topic, the *Population, Concept, Context* (PCC) mnemonic proposed by the JBI manual was considered (30). This PCC ensured that the review and its guiding questions remained transparent and focused. To maximize the breadth of evidence included, the population component encompassed athletic environments, sports organisations, and medical professionals working within sport. The concept addressed all topics relevant to SRC management policies, protocols, and guidelines. The context was deliberately broad, capturing a diverse variety of evidence on the topic, inclusive of sports settings across various regions and levels of performance. The protocol was drafted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines in accordance with the JBI Scoping Review Network, requiring registration information (29, 30). The final protocol was registered with the Open Science Framework (OSF) on October 17th, 2024 (31). The stages taken from these guidelines included:

1. Protocol and Rationale Development of PRISMA-ScR
2. Preliminary Search
3. Search Strategy
4. Registration
5. Search
    a. Phase 1 – Initial Title and Abstract Screening
    b. Phase 2 – Full-Text Review
6. Extraction and Data Charting
7. Synthesis of Results
8. Summary of Evidence

Given the substantial volume and heterogeneity of SRC-related literature, spanning different sports, healthcare systems, and professional roles, a scoping review was selected as the most appropriate method. Unlike systematic reviews, which aim to answer a narrowly focused question to evaluate the literature, scoping reviews are pertinent for sifting through diverse evidence. This approach allows researchers to capture a comprehensive overview of the range, content, and variability in published and grey literature, without narrowing inclusion to specific outcomes or intervention effectiveness. It also permits the inclusion of diverse evidence types, supporting the examination of how SRC-related knowledge is developed, disseminated, and implemented across contexts. This methodological flexibility made it well-suited to explore the inconsistencies, overlaps, and omissions within SRC guidance. The scoping review approach was therefore instrumental in identifying patterns across global SRC documents, setting the foundation for a critical understanding of current practices and future directions for concussion policy development.

3.2 Definitions and Terminology

For the purposes of this review, combat, contact, and collision sports were collectively defined as sports in which physical engagement and forceful interactions between players are inherent or present a high-risk during gameplay. These include sports where purposeful body-to-body collisions or intentional contact occur as a standard aspect of play, and where such contact is often required or likely for competitive objectives (32, 33). This definition guided the selection of included sports, prioritising those with higher risks of SRC due to the nature of physical interactions. In alignment with Cohen et al., high-risk sports are defined as those where participants accept the possibility of severe injury as an inherent element of the sport (34). These risks may come from high-impact collisions,

elevated speeds, falls, or the use of equipment that may heighten injury potential. These definitions guided the selection of mainstream sports with elevated SRC risk due to their physical demands. Mainstream sports are widely recognised and practiced sports with significant popularity, widespread media coverage, and appeal to a wide audience (35, 36). Conversely, uncommon or niche sports with minimal SRC risk were excluded (e.g. Netball, Badminton).

Included sports were adapted from the International Olympic Committee (IOC) Olympics Sports List available online, and subsequently refined to a final selection of 22 sports based on the above definitions (37). Examples of included sports are rugby, American football, association football, MMA, and ice hockey. A full list of included sports is available in Appendix I.

3.3 Eligibility Criteria

This review included evidence and guidelines that focus on SRC protocols, policies, and management guidelines across various sports and geographic locations. This review included peer-reviewed and grey literature sources published within the past ten years. Where multiple versions of a guideline, policy, or protocol were identified for the same organisation or governing body, the most recent version was retained for inclusion to best reflect current practice. Criteria were collaboratively developed by the research team to ensure a broad, yet purposeful selection aligned with the review objectives. No separate exclusion criteria were defined, as the inclusion criteria alone determined study relevance. The following criteria were established to guide the inclusion of relevant evidence (see Table 2).

Table 2

Inclusion criteria

Criterion	Description
Literature Type and Sources	All research literature and evidence describing concussion knowledge, protocols, guidelines, policies, or understood operational definitions of sport-related concussions. Types of evidence may include, but are not limited to, systematic reviews, case studies, peer-reviewed journal articles, meta-analyses, clinical guidelines, qualitative studies, reviews, conference abstracts, consensus statements, and high-quality grey literature (e.g., medical guidelines, best practices, policy documents).
Context	Evidence set specifically within sporting and athletic performance contexts. Contextual setting is focused on high-performance sport, defined as organised competitive sporting environments including elite, professional, national, international, and high-performance amateur contexts where formal medical oversight and SRC protocols are typically in place.
Guideline Focus	Literature and evidence involving medical professionals working within athletic and sport contexts. Guidelines included must be directed towards involved medical professionals (e.g., sports physicians, athletic trainers, physiotherapists, sports therapists, etc.).
Concussion Definition	Evidence including definition of SRC, concussion, or related nomenclature. For example, sport-related concussions are defined as traumatic brain injuries caused by direct or indirect forces to the head, neck, or body, including blows to the head (3). The resulting impulsive force transmitted to the brain within sport and exercise-related contexts elicits the potential for both acute and/or prolonged symptomology (1). Similar definitions of concussions are also considered.
Publication Date	Sources must have been published between 2014 and 2024. When multiple versions of a guideline or protocol existed for a particular organisation or region, the most recent version was selected to best represent current practice and ensure up-to-date inclusion. The last decade captures multiple iterations of international concussion statements and policies, allowing for examination of how evolving recommendations have been translated into guidance across sports. Earlier documents were excluded to avoid representing management approaches that no longer reflect implementation in SRC care.
Language and Geographical Inclusions	Evidence published in English, with no geographical limitations. All applicable and available regions are considered.
Data Accessibility	Evidence with accessible full-text data.

SRC guidelines specific to para-athletes were excluded from this review. These guidelines often require adapted assessment tools, individualised RTP protocols, and additional considerations for athletes with pre-existing conditions such as cerebral palsy or spinal cord injuries. Due to these fundamental differences, comparing them directly with able-bodied protocols was not methodologically appropriate. This review, therefore, focused exclusively on SRC guidance for able-bodied athletes to maintain analytical consistency.

3.4 Protocol Preparation

The protocol for this scoping review was developed following the PRISMA-ScR and JBI Manual for Evidence Synthesis guidelines (29, 30). These frameworks supported the design of a systematic and transparent search strategy aligned with the review objectives. The protocol was initially drafted by one reviewer, then refined in consultation with the research supervisory team and an academic librarian from the School of Sport, Rehabilitation, and Exercise Science at the University of Essex. Final consensus was reached through this collaborative process.

3.5 Preliminary Search

A preliminary search was conducted on October 15th, 2024, to identify existing reviews on this topic, evaluate database relevance, and assess the availability of evidence (29, 30). Keywords such as ‘concussion’, ‘high-performance’, ‘sport’, ‘policy’, ‘guideline’, and ‘protocol’ were tested in various combinations (e.g., ‘concussion’ and ‘protocol’; ‘head injury’ and ‘guideline’). The results of this exploratory phase informed the formal search strategy, helped refine the eligibility criteria, and supported database selection for the main review. Several prior reviews were identified that explored aspects of SRC management,

policy, and diagnosis. For example, Demetriades and colleagues provided valuable insight into the challenges of concussion management within football (38). However, most existing systematic and scoping reviews were narrow in scope, often limited to a specific sport, region, population, or single phase of SRC management. A common criticism in the literature was that discrepancies between sport-specific guidelines may fail to reduce the risk of SRC (39). These limitations reinforced the need for a more comprehensive, global synthesis of concussion-related policies and protocols.

3.6 Information Sources

This review drew on both academic and grey literature sources focused on SRC knowledge, protocols, guidelines, policies, and operational definitions. Included evidence encompassed systematic reviews, case studies, peer-reviewed journal articles, meta-analyses, clinical guidelines, qualitative studies, reviews, conference abstracts, consensus statements, and high-quality grey literature (e.g., medical guidelines, best practices, policy documents, and organisational procedures). To ensure comprehensive coverage, a multi-source search strategy was developed. Academic databases accessed through the University of Essex included PubMed, SPORTDiscus, Web of Science, MEDLINE, APA PsycINFO, and APA PsycARTICLES. These were selected for their relevance to sports medicine, injury prevention, and rehabilitation, and were confirmed in consultation with the research team.

The Yale MeSH Analyser was used to identify relevant Medical Subject Headings (MeSH) terms related to SRC policy and guidelines (40). This enhanced the precision of searches and helped capture clinically relevant, policy-focused literature. Grey literature was identified using Google and Google Scholar, applying advanced search settings, targeted keywords, and domain filters. This included documents from national governing bodies

(NGBs), sport organisations, and government websites. Additionally, Overton, a public policy database, was used to locate guidelines and policies from international federations and research institutions not indexed in academic databases.

3.7 Data Charting

A data-charting plan was independently developed by a single reviewer and appraised by the research team to determine which variables to extract. For this review, data extraction was organised using a structured summary table that captured metadata such as the source title, authors, year of publication, and type of evidence (e.g., journal article, policy report). Extracted data also included definitions of concussion, prevention strategies, injury-specific information (e.g., timelines, aftercare), and SRC management procedures and timelines where available. In alignment with JBI and PRISMA-ScR guidelines, the extraction process was designed to be both comprehensive and iterative (29, 30). The table was regularly updated throughout the review to accommodate newly identified or previously overlooked information and to ensure consistency in the variables collected.

3.8 Search Strategy

The search strategy was designed as a multi-phase process to locate both published academic and grey literature evidence (30). Adapting JBI recommendations, phase one included identifying initial keywords based on field knowledge, conducting a preliminary search, and analysing the titles, abstracts, and index terms of relevant papers. This informed the creation of a comprehensive and database-specific search strategy. Phase two involved performing tailored searches for each database. A summarised search strategy table is presented in Table 3. The full search strategy for PUBMED is detailed in Appendix II.

Boolean operators, such as 'AND,' 'OR,' and 'NOT,' were used across databases, including PUBMED and EBSCO, to ensure that the search captured the most relevant evidence without unnecessary overlap or omission of critical sources. In addition to these formal academic search methods, a manual search of grey literature was conducted to capture relevant SRC policies not available through a standard search (see Section 3.10).

Table 3

Summarised search strategy

Phase	Component	Details
Phase One	1. Initial Keyword Isolation	Keywords included 'concussion' and 'protocol', guided by librarian input.
	2. Synonym Generation	Synonyms included ‘head injury’, ‘mTBI’, ‘policy’, ‘guideline’, etc., identified to expand the search.
	3. PMID Yale MeSH Analysis	Yale MeSH Analyser used on CISG (PMID: 37316210) and ACRM (PMID: 37211140).
	4. Resulting Keywords	Terms: 'brain concussion', 'athletes', 'sport', 'diagnostic', 'rehabilitation', etc.
Phase Two	1. Search String Example	PubMed search string: (concussion OR mild traumatic brain injury OR mild tbi OR mtbi OR tbi) AND (policy OR policies OR law OR regulation OR guidelines) AND (professional sports OR elite sports OR advanced athletics).
	2. Filters Applied	Limited to 2014–2024, English language restriction, excluded no full-text/abstracts.
	3. Screening Tool	Rayyan™ used for screening, deduplication, and exclusion tagging.
	4. Manual Search	Manual search conducted to include additionally relevant guidelines not included in database and grey literature search.

3.9 Screening and Selection

3.9.1 Academic and Grey Literature Screening

The study followed a structured, two-phase screening protocol. In Phase One, titles and abstracts were screened to remove duplicates and exclude irrelevant sources. In Phase Two, full texts were reviewed against the pre-established inclusion criteria to confirm relevance. All screening was conducted manually by the primary reviewer using Rayyan™ software to support organisation and transparency.

- **Phase 1 – Initial Title and Abstract Screening:** Titles, abstracts, and brief descriptions were reviewed to determine alignment with inclusion criteria. Duplicates were removed using Rayyan™, and eligible sources were advanced to full-text review.
- **Phase 2 – Full-Text Review:** Each retained source was evaluated in full to verify its relevance to the research question and PCC framework. Only sources that fully met the inclusion criteria were retained for final analysis.

In addition to the formal academic database search and eligibility screening described above, a supplementary manual search was included in the search strategy to identify relevant national and international concussion policies not indexed in academic databases. This search involved systematically reviewing official websites of national sport organisations, government health agencies, and sport-related web sources. The process was guided by the same eligibility criteria as the academic screening phases and was designed to enhance the comprehensiveness of the review by capturing high-quality grey literature that addressed the review objectives. If the eligibility of a source remained unclear after screening, it was flagged by the reviewer and discussed with the supervisory team to reach a consensus.

3.10 Manual Search

Following the predefined protocol, the review process included a two-part manual search to supplement academic database screening. This component was integrated to capture essential evidence, such as guidelines and policies not found within academic search tools.

- **Manual Search Part One - Targeted Search:** Retrieved relevant guidelines and policies referenced within academic sources or known to be in use but not indexed within academic sources (n=15).
- **Manual Search Part Two - Cross Reference:** A systematic cross-reference was conducted across 194 countries and 22 sports using a structured spreadsheet and colour-coded classification system. This matrix assessed the presence or absence of SRC protocols. A detailed protocol for this process is provided in Section 3.10.1.

In total, 30 documents were added to the evidence pool through manual searching. These included national policies, sport-specific protocols, and key international guidelines not identified in the academic search. Appendix III provides an overview of the sports and countries reviewed. This process ensured the inclusion of diverse global practices and highlighted notable gaps in SRC guidance across multiple regions and disciplines.

3.10.1 Cross-Reference Overview

To comprehensively assess global SRC policy implementation, a structured cross-reference search was conducted across 194 countries and 22 sports. Each country–sport

pairing was entered into the matrix and colour-coded to indicate the presence (green), general or external reference (yellow), or absence (red) of an SRC protocol. This process yielded a total of 4,485 cells. Of these, 86 were marked green, representing potentially new pieces of evidence. Following this identification, each green-coded entry was manually reviewed to ensure it met the inclusion criteria. First, duplicate entries were identified and removed (n=10). Then, evidence that did not meet the study's criteria, such as insufficient target audience relevance or a lack of specificity to sport or region, was excluded (n=16). After this screening, 60 unique pieces of evidence were retained and added to the final dataset. Overall, the cross-reference method significantly contributed to the final review pool, bringing the total number of included documents to 115. Additional details, including the full matrix structure, are available in Appendix IV.

3.10.1.1 Cross-Reference Process for Manual Search

The cross-reference protocol used a detailed spreadsheet in Microsoft Excel (Version 16.94, 2025) to evaluate the presence or absence of SRC policies globally. This spreadsheet served as the foundation for cross-referencing, allowing systematic assessment of SRC policies across sports and nations. It was structured as follows:

1. **Axis Structure:**
    - The Y-axis listed all 194 recognised countries (provided in Appendix III) alongside an additional category labelled "International" to account for international governing bodies or organisations with applicable policies.
    - The X-axis listed all 22 relevant sports, defined by the established criteria for combat, contact, and collision sports. An additional "General" category was

included for cross-sport evidence, such as the *Concussion in Australian Sport Position Statement* (41).

2. **Color-Coding System for Identification:**
    - **Green:** Indicates a sport-specific SRC policy existed. The name of the policy was noted in the cell.
    - **Yellow:** Indicates a general or external guideline applied in place of a sport-specific one. For example, Australian baseball uses the general national guideline (41).
    - **Red:** Indicates no relevant SRC protocol was found. Cells labelled "N/A" signify the absence of evidence.

3.11 Analysis Framework

3.11.1 Template Analysis Overview

Template analysis (TEMP-A) is a structured yet flexible form of thematic analysis (THEM-A) used in qualitative research to analyse textual data (42). It incorporates key methodological steps such as data familiarization, which involves the co-existence of two practices: data-set immersion and critical engagement (43)**.** Immersion involves deep familiarisation with the data through repeated engagement, while critical engagement requires maintaining analytical distance to actively question, interpret, and challenge assumptions within the data (43). Additionally, TEMP-A draws on THEM-A strategies by recognising that coding is a continuous and reflexive process in which researchers are actively engaged, and in which codes and code labels evolve through repeated cycles of refinement (44, 45). The method also supports hierarchical coding structures, allowing researchers to organise information while adapting the framework to suit study needs (46).

TEMP-A was selected for this review due to its capacity to accommodate diverse types of evidence, including peer-reviewed academic literature and grey literature. This dual approach, combining predefined codes informed by established SRC domains with emergent codes from the data, supported a robust yet adaptable analysis process (45, 46). Given the heterogeneity of concussion-related policies, diagnostic criteria, and management guidelines across contexts, TEMP-A enabled meaningful synthesis across sources that varied in scope, terminology, and structure. The flexibility of this method allowed for seamless reorganisation or reclassification of themes as needed (46). Its use in implementation-focused health studies further supports its appropriateness for synthesizing policy and practice-related findings across complex, context-dependent materials (47, 48). For this PRISMA-ScR, TEMP-A provided a systematic approach to comparing and synthesizing information across diverse sources.

3.11.1.1 Project Paradigm

The TEMP-A undertaken as part of this PRIMSA-ScR was conducted within a pragmatist research approach that incorporated interpretive analytical judgement. While the scoping review followed outlined and structured procedures for searching, screening, and extraction, the synthesis of evidence required interpretive decision-making in the development, refinement, and application of templates. This process involved active engagement with the data, comparison across heterogeneous sources, and ongoing reflexive consideration of how meaning and patterns were constructed across the literature. Rigour was supported through transparency, reflexive engagement, and coherence of coding decisions, rather than through objectivist criteria such as accuracy, validity, or reliability (49). These latter terms are more closely aligned with assumptions of replicability, which were not

consistent with the aims of the scoping synthesis. Instead, emphasis was placed on producing a transparent and reflexively informed representation of patterns across the SRC literature.

3.11.1.2 Template Analysis Steps

TEMP-A is a flexible method for qualitative data analysis, involving a structured, adaptable process where reflexivity is essential. The steps for TEMP-A have been adapted from both King and Brooks et al. for this PRISMA-ScR and are available in Table 4 (46, 50). The analysis begins with data familiarization, where researchers review documents to identify initial patterns and key details. Preliminary coding follows, allowing for the identification of initial themes that can guide the process. An initial coding template is then developed and tested on a subset of the data, which allows for code refinement. Codes may be added, removed, or adjusted to better fit emerging insights. The refined template is then systematically applied to the full dataset, organising content into structured themes and sub-themes. These themes are further analysed and synthesised, exploring patterns, relationships, and gaps within the data. This approach ensures that the analysis is both comprehensive and responsive to the nuances of the data.

Table 4

Adapted steps for template analysis

Steps	Description of Analysis
1. Familiarize Yourself with the Data	All relevant documents are reviewed to gain an initial understanding of the content, identifying recurring topics, key details, and patterns.
2. Preliminary Coding	These predefined categories that may be refined or discarded as the analysis progresses.
3. Organize Themes	Group emerging themes into clusters and define relationships within and across groups. This includes hierarchical structures (broad themes summarising narrower ones) and lateral connections between clusters.
4. Initial Template Development	Based on preliminary coding, create an initial version of the coding template.
5. Code a Subset of the Data	Apply the initial template to a small portion of the dataset, assessing how well it captures the information. This phase helps identify necessary refinements.
6. Template Refinement	Adjust the template based on the pilot coding. Modify themes by adding new ones, merging redundant ones, or redefining categories as patterns emerge.
7. Apply the Template to the Full Dataset	Use the revised template to systematically code the entire dataset, ensuring consistency in thematic organisation.
8. Identify and Organize Themes	Categorize related codes into broader themes and sub-themes, establishing their significance within the dataset. Integrative themes spanning multiple clusters should be identified.
9. Interpret the Data	Analyse the themes and their relationships to address the research questions. Identify patterns, gaps, and key insights. Supporting examples or quotes can help illustrate findings.
10. Report the Findings	Present a structured narrative that explains the identified themes, their significance, and their implications for the research.

3.11.2 Template Development and Refinement

Following data familiarisation, an initial coding template was developed based on the review objectives, evidence content, and key SRC domains such as RTP, sideline management, and long-term care. Coding was conducted in NVivo (v15.1.0), which supported systematic organisation of codes and flexible template adjustments. As analysis progressed, the template was refined to reduce redundancy and better reflect patterns in the evidence. For instance, subthemes such as rest periods and recovery timelines were merged under a single "recovery timeline" code, while underrepresented themes (e.g., "head injury terminology" as a standalone category) were removed. These adjustments followed TEMP-A guidelines, which support structural modification when applied consistently across the dataset (46, 50). The final template was developed using a subset of data and then applied across all sources, ensuring a rigorous and transparent approach. A side-by-side comparison of the initial and final templates is provided in Appendix V.

3.11.3 Synthesis Reliability and Reconciliation

The synthesis process was conducted by a single reviewer, ensuring consistency and rigor throughout the extraction and analysis of relevant evidence; however, rigour was supported through consultation with the supervisory team. While the reviewer independently carried out the synthesis, the supervisory research team was available if clarification or critical synthesis decisions were required. For example, dedicated meetings focused on identifying which domains of SRC were most pivotal for both clinical practice and policy interpretation, including concussion definitions, sideline assessment protocols, RTP progressions, and follow-up care. These discussions informed the refinement of synthesis categories and later shaped the structure of summary tables available in Appendix IX. If ambiguity arose in how concepts were presented across sources, collaborative discussion

supported any necessary reconciliation and helped ensure synthesis decisions were coherent and grounded in the evidence base.

3.12 Traffic Light Table: Grading and Interpretation

To further support the synthesis of findings and highlight variation across included evidence, a customised grading framework was developed to evaluate the comprehensiveness and clarity of each policy, protocol, or guideline. Although visually distinct, Table 5 does not constitute a separate analytic method. Rather, it was developed as a post-coding synthesis tool to assist in interpreting and visually summarising the thematic findings. This framework was applied after the thematic (TEMP-A) coding process and was designed to enable rapid cross-document comparison and pattern recognition. Each source was assessed for the presence, absence, or partial inclusion of key SRC components, including RTP protocols, sideline management strategies, injury definitions, and long-term follow-up care. These assessments were visualised in a colour-coded "traffic light" table. A green cell indicated that the component was clearly and explicitly present ("Yes"), yellow signified partial or vague inclusion ("Other"), and red represented complete absence or inaccessible information ("No"). In addition, an overall document score was assigned using a cumulative grading scale ranging from "Excellent" to "Worst", based on the number of components that were comprehensively addressed. The rationale for this method emerged during initial screening and coding, where early observations revealed substantial variability in how SRC domains were presented. The traffic light system was thus developed to capture these inconsistencies in a structured, visually accessible format. The final grading table is presented below (Table 5), with further explanation of the scoring approach available in Appendix VI.

Table 5

Traffic light table: cross-evidence grading of SRC components

Table 5 Continued.

Evidence Info	SRC Definition	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	OVERALL
SRC South Africa, 2025 [51]	Yes	Yes	Yes	Yes	Yes	Excellent
Softball Canada, 2025 [52]	Yes	Yes	Yes	Yes	Yes	Excellent
Cancelliere et al., 2024 [53]	Yes	Yes	Yes	Yes	Yes	Excellent
Broglio et al., 2024 [54]	Yes	Yes	Yes	Yes	Yes	Excellent
ECB, 2024 [55]	Yes	Yes	Yes	Yes	Yes	Excellent
FIFA, 2024 [56]	Yes	Yes	Yes	Yes	Yes	Excellent
Parachute, 2024 [57]	Yes	Yes	Yes	Yes	Yes	Excellent
ACC, 2024 [58]	Yes	Yes	Yes	Yes	Yes	Excellent
Basketball Australia, 2024 [59]	Yes	Yes	Yes	Yes	Yes	Excellent
Hockey Australia, 2024 [60]	Yes	Yes	Yes	Yes	Yes	Excellent
Lacrosse Canada, 2024 [61]	Yes	Yes	Yes	Yes	Yes	Excellent
SARU, 2024 [62]	Yes	Yes	Yes	Yes	Yes	Excellent
Whitehouse & Newcombe, 2023 [63]	Yes	Yes	Yes	Yes	Yes	Excellent
Patricios et al., 2023 [1]	Yes	Yes	Yes	Yes	Yes	Excellent
England Football, 2023 [64]	Yes	Yes	Yes	Yes	Yes	Excellent
British Cycling, 2023 [65]	Yes	Yes	Yes	Yes	Yes	Excellent
NCAA, 2023 [66]	Yes	Yes	Yes	Yes	Yes	Excellent
HEADCASE, 2023 [67]	Yes	Yes	Yes	Yes	Yes	Excellent
MNZ, 2022 [68]	Yes	Yes	Yes	Yes	Yes	Excellent
Herring et al., 2021 [69]	Yes	Yes	Yes	Yes	Yes	Excellent
Taekwondo Canada, 2021 [70]	Yes	Yes	Yes	Yes	Yes	Excellent
Silverberg et al., 2020 [71]	Yes	Yes	Yes	Yes	Yes	Excellent

Table 5 Continued.

Evidence Info	SRC Definition	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	OVERALL
ICC, 2024 [72]	Yes	Yes	Yes	Yes	Yes	Excellent
Cycling Canada, 2020 [73]	Yes	Yes	Yes	Yes	Yes	Excellent
Equestrian Canada, 2020 [74]	Yes	Yes	Yes	Yes	Yes	Excellent
Casey & Fonseca, 2019 [75]	Yes	Yes	Yes	Yes	Yes	Excellent
Canada Basketball, 2019 [76]	Yes	Yes	Yes	Yes	Yes	Excellent
Broglio et al., 2019 [77]	Yes	Yes	Yes	Yes	Yes	Excellent
McCrory et al., 2017 [3]	Yes	Yes	Yes	Yes	Yes	Excellent
SMA, 2018 [78]	Yes	Yes	Yes	Yes	Yes	Excellent
McCrea & Guskiewicz, 2014 [79]	Yes	Yes	Yes	Yes	Yes	Excellent
Broglio et al., 2014 [80]	Yes	Yes	Yes	Yes	Yes	Excellent
NFL HNSC, 2022 [81]	Yes	Yes	Yes	Yes	Other	Good
Sport Singapore, 2019 [82]	Yes	Yes	Yes	Yes	Other	Good
AusCycling, 2025 [83]	Yes	Yes	Yes	Yes	No	Fair
Prock et al., 2024 [84]	No	Yes	Yes	Yes	Yes	Fair
Demetriades et al., 2024 [38]	Yes	Yes	Yes	Yes	No	Fair
FIBA, 2024 [85]	Yes	Yes	Yes	Yes	No	Fair
ASC, 2024 [86]	Yes	Yes	Yes	Yes	No	Fair
Equestrian Sports NZ, 2024 [87]	Yes	No	Yes	Yes	Yes	Fair
Karate Australia, 2024 [88]	Yes	No	Yes	Yes	Yes	Fair
Volleyball Canada, 2024 [89]	No	Yes	Yes	Yes	Yes	Fair
British Equestrian, 2023 [90]	Yes	No	Yes	Yes	Yes	Fair
Banks & Eyres, 2023 [91]	Yes	Yes	Yes	Yes	No	Fair
Hamdan et al., 2022 [92]	Yes	Yes	Yes	Yes	No	Fair
NRL, 2021 [93]	Yes	No	Yes	Yes	Yes	Fair
Field Hockey Canada, 2021 [94]	Yes	Yes	Yes	Yes	No	Fair

Table 5 Continued.

Evidence Info	SRC Definition	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	OVERALL
Davis et al., 2020 [95]	No	Yes	Yes	Yes	Yes	Fair
GB & England Hockey, 2020 [96]	Yes	No	Yes	Yes	Yes	Fair
Comeau & Pfeifer, 2019 [97]	Yes	Yes	Yes	Other	Other	Fair
Neidecker et al., 2019 [98]	Yes	Yes	Yes	Yes	No	Fair
Elkington et al., 2019 [41]	Yes	Yes	Yes	Yes	No	Fair
Baseball Canada, 2019 [99]	No	Yes	Yes	Yes	Yes	Fair
Canada Rugby League, 2019 [100]	Yes	Yes	Yes	Yes	No	Fair
Ellenbogen et al., 2018 [101]	Yes	Yes	Yes	Yes	No	Fair
Canada Soccer, 2018 [102]	Yes	No	Yes	Yes	Yes	Fair
Wrestling Canada Lutte, 2018 [103]	No	Yes	Yes	Yes	Yes	Fair
Cochrane et al., 2017 [104]	Yes	Yes	Yes	Yes	No	Fair
Elkington & Hughes, 2017 [105]	Yes	Yes	Yes	Yes	No	Fair
Abreu et al., 2016 [106]	Yes	Yes	Yes	Yes	No	Fair
Basketball England, 2016 [107]	Yes	No	Yes	Yes	Yes	Fair
CDC, 2025 [108]	Yes	Yes	Other	Yes	No	Moderate
NHL, 2022 [109]	Other	Yes	Yes	Yes	No	Moderate
Gunasekaran et al., 2020 [110]	Other	Yes	Yes	Yes	No	Moderate
Hubertus et al., 2019 [111]	Yes	No	Yes	Yes	Other	Moderate
Wicklund et al., 2018 [112]	Yes	Yes	Other	Yes	No	Moderate
US Equestrian, 2025 [113]	No	Yes	Yes	Yes	No	Poor
Hohmann et al., 2024 [114]	No	Yes	Yes	Yes	No	Poor
World Rugby, 2024 [115]	Yes	No	Yes	Yes	No	Poor
Jacobi et al., 2023 [116]	No	Yes	Yes	Yes	No	Poor
FEI, 2023 [117]	Yes	No	Yes	Yes	No	Poor
Meyer et al., 2023 [118]	No	Yes	Yes	Yes	No	Poor

Table 5 Continued.

Evidence Info	SRC Definition	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	OVERALL
Echemendia & Hong, 2023 [119]	Yes	Yes	No	Yes	No	Poor
McLarnon et al., 2022 [120]	Yes	No	Yes	Yes	No	Poor
AFL, 2022 [121]	Yes	Yes	No	No	Yes	Poor
Equestrian Australia, 2021 [122]	Yes	No	Yes	Yes	No	Poor
Falahati, 2021 [123]	Yes	No	Yes	Yes	No	Poor
Tarzi et al., 2020 [124]	Yes	Yes	Other	Other	No	Poor
Cricket Australia, 2020 [125]	No	Yes	Yes	Yes	No	Poor
Rugby Australia, 2019 [126]	Yes	No	Yes	Yes	No	Poor
Football Australia, 2019 [127]	Yes	No	Yes	Yes	No	Poor
NZF, 2018 [128]	Yes	No	Yes	Yes	No	Poor
Medical Equestrian Association Ireland, 2016 [129]	Yes	No	Yes	Yes	No	Poor
Pangrazio et al., 2024 [130]	Yes	Yes	Other	No	No	Very Poor
Patricios et al., 2023 [131]	No	Other	No	Yes	Yes	Very Poor
CASC Ontario, 2021 [132]	No	Yes	Other	Yes	No	Very Poor
NBA, 2017 [133]	Other	Yes	No	Yes	No	Very Poor
Kickboxing GB, 2025 [134]	No	No	Yes	Yes	No	Worst
FiA, 2024 [135]	Yes	No	No	No	No	Worst
Motorsport UK, 2024 [136]	No	No	No	No	No	Worst
UCI, 2024 [137]	No	No	Yes	Yes	No	Worst
NZIHF, 2024 [138]	No	No	Yes	Yes	No	Worst
NZ Lacrosse, 2024 [139]	No	No	No	Yes	No	Worst
FIVB, 2024 [140]	No	No	No	Yes	No	Worst
NICE, 2023 [141]	No	Yes	No	No	No	Worst
Echemendia et al., 2023 [142]	No	Yes	Yes	No	No	Worst

Table 5 Continued.

Evidence Info	SRC Definition	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	OVERALL
USA Wrestling, 2023 [143]	No	No	No	No	No	Worst
du Preez et al., 2022 [144]	No	No	Other	Yes	No	Worst
Swart et al., 2021 [145]	No	No	Yes	Yes	No	Worst
The Danish Concussion Center, 2021 [146]	No	No	No	No	Yes	Worst
UK Government, 2021 [147]	Yes	Yes	No	No	No	Worst
IIHF, 2021 [148]	No	No	Yes	Yes	No	Worst
WAKO, 2021 [149]	No	No	No	No	No	Worst
Lempke et al., 2020 [150]	No	No	No	Yes	No	Worst
Motorsport Australia, 2020 [151]	No	No	Yes	Yes	No	Worst
AIBA, 2020 [152]	No	No	Yes	No	No	Worst
Boxing Canada, 2020 [153]	No	No	No	Yes	No	Worst
World Lacrosse, 2020 [154]	Yes	No	No	No	No	Worst
Satarasinghe et al., 2019 [155]	No	No	No	Yes	No	Worst
Elliot et al., 2019 [156]	Yes	No	Yes	No	No	Worst
Frémont & Schneider, 2019 [157]	No	No	No	Yes	No	Worst
Stuart et al., 2019 [158]	No	No	Yes	Yes	No	Worst
World Taekwondo, 2019 [159]	No	Yes	Yes	No	No	Worst
Niederer et al., 2018 [160]	No	Yes	No	Other	No	Worst
Nalepa et al., 2017 [161]	No	Other	Other	Yes	No	Worst

Note: To aid interpretation, each policy was assigned a score based on five categories: definition of SRC, preventive strategies, sideline evaluation, return-to-play guidance, and follow-up care. For each category, a "Yes" response was scored as +1, "No" as –1, and "Other" (partial or unclear guidance) as 0. These scores were summed to produce a total score ranging from –5 to +5. Final ratings were then categorized as Excellent (5), Good (4), Fair (3), Moderate (2), Poor (1), Very Poor (0), or Worst (-1 to -5), based on score ranges. A detailed breakdown of the scoring system and colour-coded rating scale is provided in Appendix VI**.**

Section 4 - Findings

4.1 Source Selection and Characteristics

4.1.1 PRISMA Selection Process

All citations (n=490) were uploaded into Rayyan™ (v.2025) for screening (162). After deduplication and title/abstract screening, 63 items were marked as ‘maybe’ and reviewed further. A total of 89 were excluded, and 42 studies met the inclusion criteria and proceeded to full-text review. No discrepancies arose between reviewers. A detailed breakdown is shown in the PRISMA flow diagram (Figure 1).

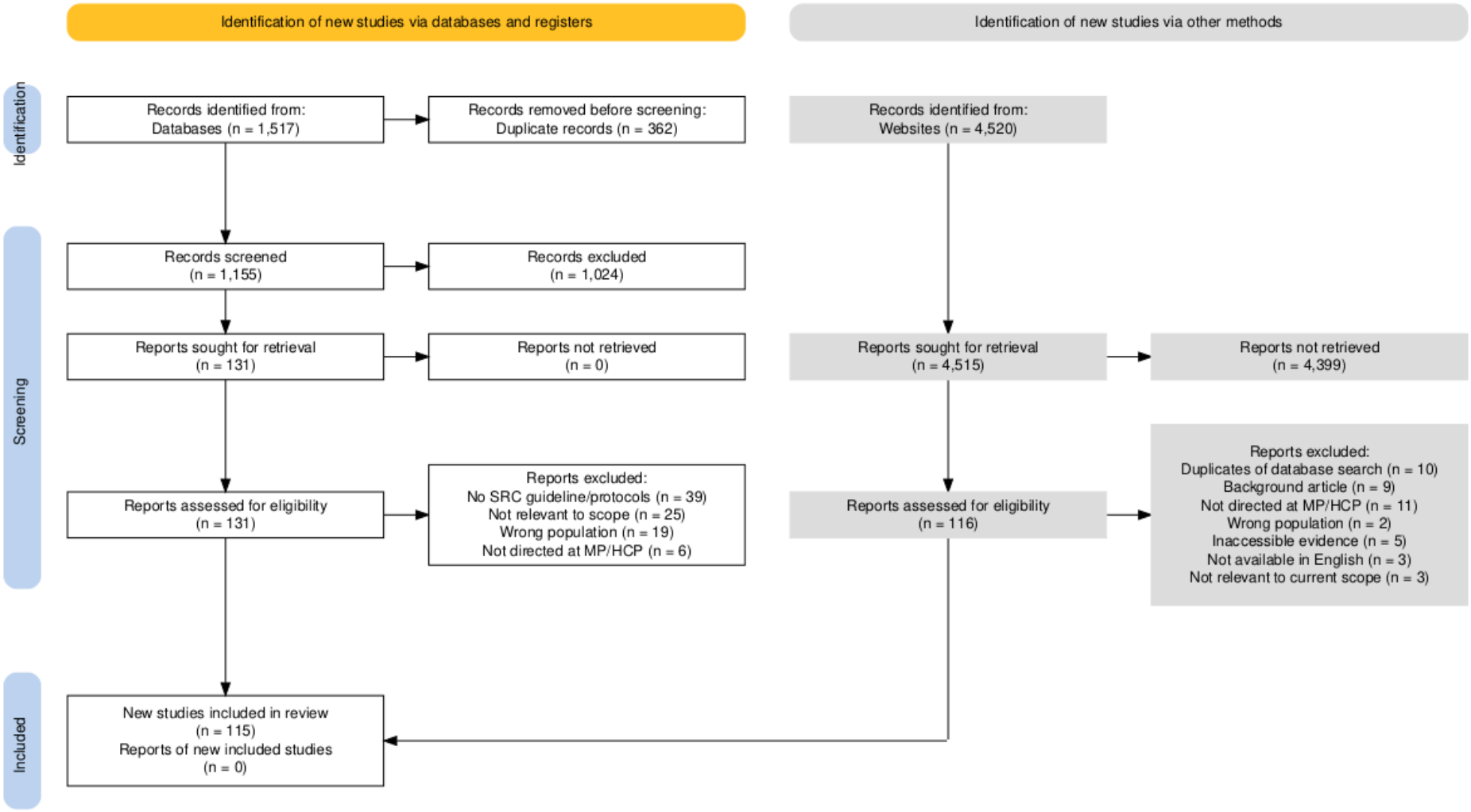

Figure 1: PRISMA flow-chart of identification, screening, eligibility and inclusion.

4.2 Characteristics of Included and Excluded Evidence

The characteristics of included sources are summarised in Appendix VII, including evidence type, sport, and publication year. Evidence that did not meet the inclusion criteria is listed in Appendix VIII, with exclusion reasons where applicable.

4.3 Template Analysis Results

4.3.1 Final Coding Template.

The final coding template was developed using the TEMP-A approach. Initial categories were drawn from recurrent themes in SRC literature, such as sideline assessments, RTP protocols, and long-term care, and then adapted based on the content of the included sources. The final template was organised into five overarching themes: *Purpose and Scope, Prevention Measures, Sideline Evaluation and Diagnosis, SRC Management Strategies,* and *Follow-Up Care and Prognosis*. Each theme is supported by a defined set of subthemes, which enabled an organised structure of the evidence content. Figure 2 provides a summarised version of the final coding template applied in NVivo. A detailed version, including nested sub-codes and codebook structure, is provided in Appendix V.

4.4 Synthesis of Findings

4.4.1 Observed Patterns in Evidence

The included evidence base, comprising 115 sources, revealed partial alignment in some areas but also considerable variation in others. While certain core elements, such as definitions of SRC, sideline procedures, or RTP considerations, appeared across multiple sources, notable diversity in formatting, terminology, and policy focus highlighted the

fragmented nature of SRC governance globally. Given this variability, the TEMP-A framework was used to organise and synthesise the evidence thematically. A traffic light rating system and summary coding table were developed to support accessibility without oversimplification (see Table 5 and Appendix V). These tools enable comparison across five core domains of SRC guidance: definition, prevention, sideline evaluation, RTP, and follow-up care. An overview of the resulting themes and subthemes is provided in Figure 2.

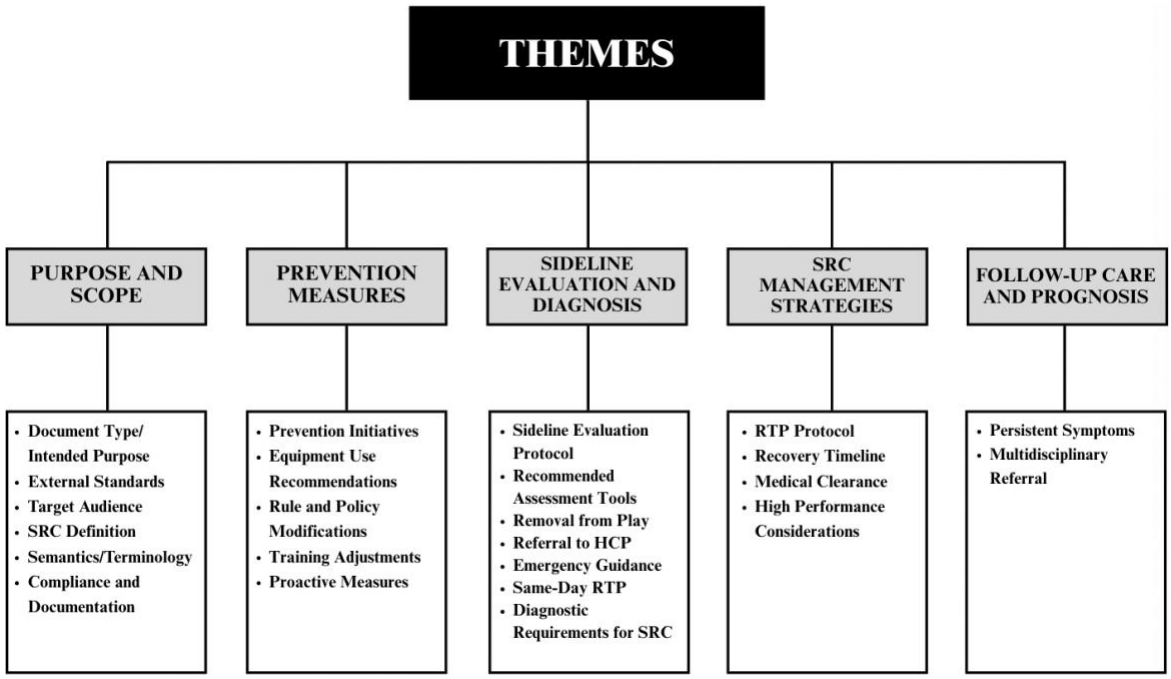

Figure 2: Final TEMP-A themes and sub-themes

Across the included sources, several broad patterns emerged. Many guidelines and policy documents either lacked an explicit definition of SRC or relied on older terminology, creating ambiguity around diagnostic criteria. Prevention strategies were inconsistently addressed, with some evidence outlining proactive interventions, such as rule modifications,

equipment use, or baseline testing, while others offered no preventative framework at all. Sideline evaluation procedures varied greatly in terms of the tools recommended and the clarity of protocols, particularly regarding removal from play. RTP pathways were often included but differed in their specificity, duration, and reliance on medical advice. Follow-up care and guidance on managing persistent symptoms were among the least addressed areas, with few sources providing comprehensive recommendations for long-term support or multidisciplinary referral.

Further thematic nuances were observed. The target audience of each policy shaped its complexity and depth, with some documents tailored specifically to HCP and others written for wider audiences, including athletes, coaches, stakeholders, and medical professionals. Across the dataset, many guidance documents prioritised post-injury management, with comparatively less attention given to prevention, compliance tracking, or long-term care. Table 5 provides a traffic light visualisation of these trends across the five coding domains. The following sections provide more detailed results within each thematic category

4.5 Overview of Thematic Findings

The previous section outlined key patterns across the included sources, highlighting areas of divergence across SRC policy domains. The next sections expand upon those findings through thematic interpretation and critical analysis. Using the TEMP-A framework as a guiding structure, each core domain is explored in greater detail to assess not only the existing policies but also how they are understood within broader sporting and medical contexts. To visually summarise patterns in the dataset, Figure 3 presents a descriptive bar

chart that categorises the included sources according to the five thematic domains. The following subsections are organised around these five domains: *Purpose and Scope, Prevention Measures, Sideline Evaluation and Diagnosis, SRC Management Strategies,* and *Follow-Up Care and Prognosis.*

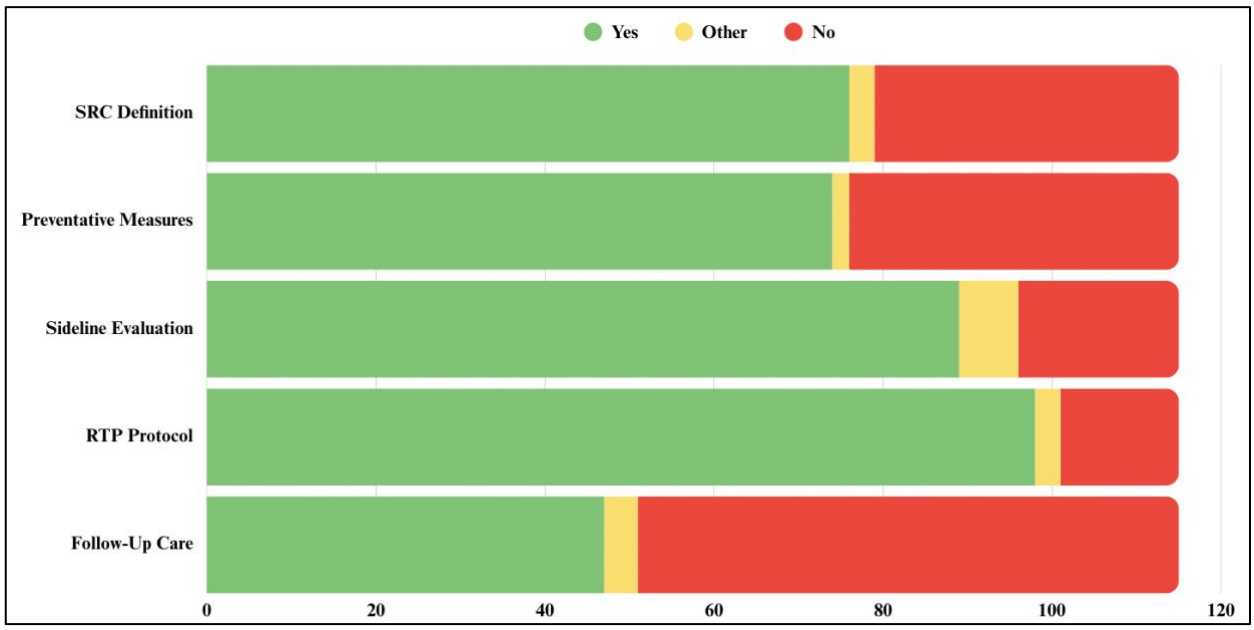

Figure 3: Scoping review evidence characteristics

4.6 Purpose and Scope

This theme examines the foundational aspects of SRC guidelines, policies, and protocols, including the intended purpose, alignment with external standards, and clarity of definitions, terminology, and target audiences. The figure below illustrates the top-level code and sub-themes.

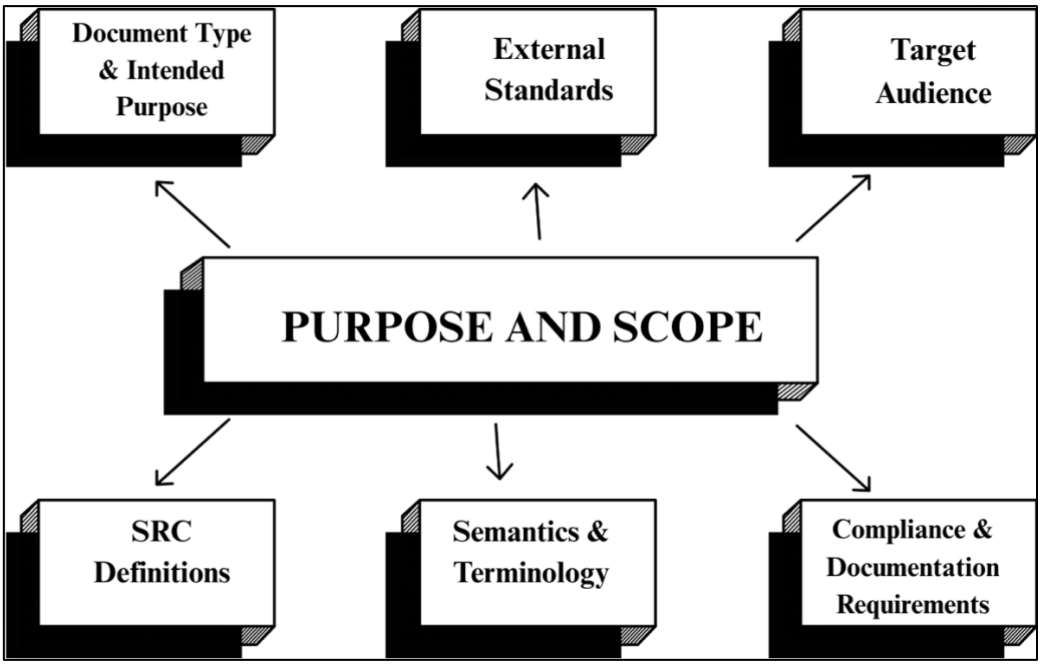

Figure 4: Top-level code one - purpose and scope

4.6.1 Document Type and Intended Purpose

Across the included evidence, there was substantial variation in how documents framed their intended purpose. Materials were commonly labelled as protocols (n=17), policies (n=20), guidelines (n=26), or 'other' informational resources (n=52), yet these labels were often used interchangeably and did not reliably distinguish documents by structure, depth, or clinical focus.

Protocols**,** which are typically expected to offer step-by-step operational instructions, varied significantly in clarity. For instance, the *NFL Head, Neck and Spine Committee's Concussion Diagnosis and Management Protocol* (81) provided detailed procedures for sideline evaluation, mandatory removal, and staged RTP guidelines across different allied HCP positions. In contrast, the *Boxing Canada Concussion Management Protocol* (153) provided summarised advice related only to the return-to-sport (RTS) portions of care. Policies included a similar structure and information to protocols. The *British Judo Traumatic Brain Injury Management Policy* (91) established enforceable frameworks with clear compliance expectations. Guidelines often attempted to balance educational information with advice regarding SRC care but varied in depth. The *Canadian Guideline on Concussion in Sport (Parachute)* (57) provided a comprehensive blend of public education, symptom management advice, and clinical RTS progression steps, but did not consistently differentiate guidance for healthcare providers from that intended for coaches, parents, or athletes.

The remaining 52 sources were classified as "other". Within this category, seven were consensus or position statements (n=7), while others included educational documents, medical recommendations, action plans, and sport federation commentary. Overall, document titles (e.g., "protocol" vs. "guideline") were poor predictors of structure, authority, or practical use. Rather than reflecting clear distinctions in content, these terms appeared to reflect organisational preference. This inconsistency complicates interpretation for practitioners, especially in contexts where overlapping documents exist and clarity of use is essential.

4.6.2 External Standards

A substantial proportion of the included evidence referenced external frameworks to guide SRC management, with 41 documents explicitly citing the CISG consensus statements (1, 3). However, the specific version cited, and the extent of integration varied by source. Most sources aligned their recommendations with the CISG version closest to their publication date. For example, documents released between the Berlin 2016 and Amsterdam 2022 statements commonly referenced the 5th (Berlin) statement, while evidence published after 2022 tended to cite the 6th (Amsterdam) statement (1, 3). For example, the *National Rugby League Policy and Guidelines for the Management of Concussion* (93) and the *Canada Basketball Concussion Policy* (76) both aligned their recommendations to the Berlin CISG consensus statement and were published prior to 2022. In contrast, the *ICC Concussion Management Guidelines* express that guidelines must follow "current best practice" and, therefore, reference the updated Amsterdam 2022 consensus (72). In general, the degree of application of external standards was inconsistent. Some documents, such as the *World Rugby Concussion Guidance* (115), closely mirrored CISG staging for RTP and emphasized medical clearance and symptom-limited activity, yet did not explicitly reference or discuss the CISG. Others, such as *British Wrestling's Concussion Guidance* (123), clearly acknowledged that recommendations were drawn from the 5th CISG consensus statement, citing principles such as graded RTP stages, but omitted details regarding multidisciplinary referral recommendations or neurocognitive assessment benchmarks.

This variability illustrates that many documents incorporate elements of CISG, such as standardised definitions or RTP staging, even without formal citation**.** One notable example is Parachute's *Canadian Guideline on Concussion in Sport* (57), which explicitly

references CISG. However, many national sport organisations within Canada (e.g., Softball Canada**,** Lacrosse Canada**,** Volleyball Canada) cite Parachute Canada directly, rather than CISG itself (52, 61, 89). This creates an indirect chain of reference, where CISG guidance shapes national protocols through intermediary frameworks. While not counted among the 41 explicit CISG references, such documents nonetheless reflect CISG influence in practice.

Beyond CISG, a small number of documents cited alternative external sources, such as the National Institute for Health and Care Excellence (NICE), or sport-specific policies such as those from the International Cricket Council (ICC) for guidance on cricket-specific SRC care (72, 141). However, these references were far less consistent and often secondary to CISG citations.

Selective referencing of external standards was evident across the dataset. For instance, the *National Basketball Association Concussion Policy Summary* (133) did not define SRC directly but included a hyperlink to the 5th CISG consensus statement. However, other components of the policy did not explicitly reference CISG recommendations (133). In other cases, documents adopted certain elements of the CISG framework, such as step-wise RTP progressions, while omitting other components like concussion prevention (e.g., policy or rule changes, training strategies) or potential long-term effects (1). This pattern suggests that although the CISG has become a widely recognised reference point internationally, its use remains uneven across sports, nations, and organisations. Such variability in the application of external guidance continues to broaden inconsistencies in SRC care and highlights the ongoing challenges in translating evidence-based information into practice.

4.6.3 Target Audience

A recurring pattern across the included evidence was the inconsistent specification of target audience. While some documents explicitly targeted medical professionals or healthcare professionals (MPs/HCPs)**,** many simultaneously addressed mixed audiences**,** including athletes, coaches, administrators, and parents, within a single document. This lack of differentiation was found in 49 of the 115 sources, many of which used vague or umbrella terms like 'individuals involved in sport' without clarifying intended scope. For example, Volleyball Canada's protocol states it is "intended for use by all individuals who have a role interacting with athletes […] including athletes, parents/caregivers, coaches, officials, teachers, trainers, and licensed healthcare professionals" (89). Documents including the *Canadian Guideline on Concussion in Sport (Parachute)*, and the *Sports Medicine Australia Concussion in Sport Policy* illustrated this trend (57, 78). Both sought to offer clinically relevant recommendations for HCPs while also aiming to educate all individuals who interact with athletes. As a result, clinical instructions (e.g., signs of SRC, RTP criteria, referral expectations) were often blended with general educational messaging. Symptom checklists and RTP procedures were frequently presented in unified documents with limited clarification regarding the scope of practice. This lack of audience differentiation introduces challenges. In SRC management, diagnosis, clinical assessment, and medical clearance responsibilities must be limited to qualified HCP (1). When RTP protocols and removal decisions are presented without clearly specifying the scope of practice, there is a risk that non-medical stakeholders or athletes themselves may attempt to apply guidance independently.

In contrast, 66 of the included sources were targeted at HCPs or academic readers, including medical protocols, peer-reviewed articles, and guidance intended for physician use.

The *Taekwondo Canada Concussion Protocol* (70) explicitly identified the intended reader for each section, distinguishing between general information and potential steps of action for HCP. The *Rugby Australia Concussion Management MD Information* (126), for example, clearly stated that the document was intended for physicians and HCP's, offering guidance specific to clinical assessment and RTP clearance procedures. Academic sources, such as the work by Hubertus et al., also tailored their recommendations for MPs and researchers, further reinforcing the importance of audience-specific guidance in SRC care (111). Overall, the inconsistent labelling and vague framing of target audiences present important challenges for clarity and implementation, especially in high-performance contexts where role-specific guidance is essential.

4.6.4 SRC Definitions

While many sources reference established definitions of SRC, particularly those aligned with the CISG consensus statements, not all provide an explicit or consistent operational definition. Across the included evidence, 66% of sources (n=76) provided an explicit definition of SRC, typically referencing or adapting CISG consensus statements. In contrast, the remaining evidence omitted a direct definition entirely or relied on external hyperlinks without embedding a clear definition within the primary document. The most referenced definition, adapted from the CISG, describes SRC as follows:

> *"Sport-related concussion is a traumatic brain injury induced by biomechanical forces, typically resulting in the rapid onset of short-lived impairment of neurological function that resolves spontaneously."*
>
> - 6th CISG Consensus Statement (Amsterdam, 2022)

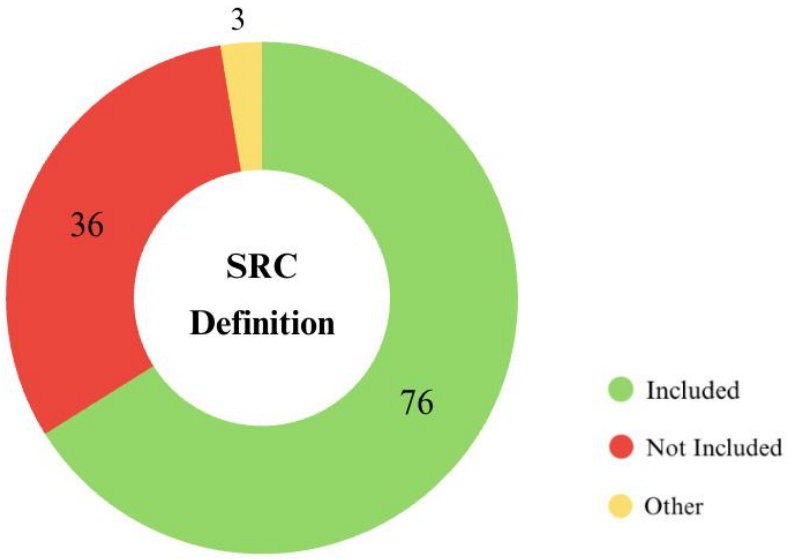

Figure 5: Frequency of explicit SRC definitions across evidence

However, not all sources adhered to this specificity. For example, *Baseball Canada Concussion Policy & Protocol* (99) referred broadly to "head injury recognition" and concussion information without formally defining the condition. Similarly, the *Canadian Automobile Sport Clubs (CASC) Concussion Protocol* (132) includes a list of terminology relevant to the protocol but lacks a structured operational definition of concussion itself. To illustrate the variability observed across the evidence base, Table 6 provides examples of definitional approaches identified during data charting. These examples were chosen to reflect a range of styles and sources (i.e., national federations, international bodies, consensus statements). A full, detailed summary of SRC definitions across all included sources is available in Appendix IX.

Table 6

Example of variability in the definition of SRC across evidence

Source	Definition Style	Notes
6th CISG Consensus Statement (Amsterdam, 2022)[1]	Explicit, operational definition of SRC as biomechanical TBI causing rapid onset of short-lived neurological dysfunction.	Used as the international standard reference across many sports.
Baseball Canada, 2019 [99]	Refers broadly to "head injuries" and "concussion", no formal standalone definition provided.	Lacks clear operational definition.
NZ Football, 2018 [128]	Refers to concussion as a TBI induced by biomechanical forces, referencing the 5th CISG consensus statement from Berlin, 2016.	Very condensed definition included.
FIFA, 2024 [56]	Explicit and detailed SRC definition tied to impulsive forces transmitted to the brain and related symptoms.	Dedicated portion in protocol to introduce and explain SRC.

This definitional variability complicates efforts to standardize management practices and contributes to divergent interpretations across sports and jurisdictions. Across this body of evidence, there remains no single, universally applied gold standard definition for SRC. Management practices, therefore, become heavily dependent on organisational policy, MP interpretation, and sport-specific considerations.

4.6.5 Semantics and Terminology

In addition to definitional variability, notable semantic patterns emerged across the included evidence, reflecting both shared messaging and some residual inconsistencies in terminology. Many sources echoed the widely recognised slogan “if in doubt, sit them out”, reinforcing a precautionary approach to SRC care. This phrasing, used in sources such as Elkington & Hughes (105), *Medical Equestrian Association Ireland* (129), and *Motorsport Australia Concussion Management Guidelines* (151) promotes the prioritisation of athlete safety through conservative decision-making. This slogan captures the ethos of immediate removal and risk avoidance, though “when in doubt, sit them out”, “recognise and remove”, and urgent advice to “permanently remove the player” if suspicions occur, were variations of this slogan seen throughout the evidence (62, 82, 158). Terminological inconsistency was observed in the dataset. Terms such as “concussion”, “head injury,” and “TBI” were used in documents discussing the same information. For instance, *Baseball Canada Concussion Policy & Protocol* (99) and *Cycling Canada Head Injury/Concussion Protocol* (73) referred to both "head injury " and “concussion” within the same document. Similarly, the NICE clinical guidelines consistently referred to “head injury” without explicitly distinguishing SRC as a distinct diagnosis (141).

While the widespread adoption of care-focused language signals growing awareness, variability in terminology may still hinder the clarity required for accurate sideline diagnosis and communication between stakeholders. Encouragingly, the common presence of safety-focused messaging like “if in doubt, sit them out” suggests a shift toward caution, even if semantic precision remains an area for continued improvement.

4.6.6 Compliance and Documentation Requirements

Across the reviewed evidence, documentation and compliance mechanisms were inconsistently addressed. While several sources required formal reporting or tracking of SRC cases, including the *Motorcycling New Zealand (MNZ) Concussion Information Guide* (68), *England Cricket Professional and Elite Academy Concussion Guidelines* (55), and FIFA’s *Concussion Protocol for Medical Staff* (56), others either omitted clear reporting procedures or delegated them to general medical clearance without specifying concussion-specific documentation. Some evidence, such as *British Cycling Sports Concussion Guidance* (65) and *US Equestrian Concussion Safety* (113) website, encourages injury report completion and formal medical assessment, but do not establish mandatory documentation or compliance systems. While 24 documents were coded as explicitly including documentation requirements, this figure does not account for sources where procedures may be implied, minimally described, or embedded in broader sections without clear labelling. Most documents lacked enforcement mechanisms or penalties for non-compliance.

Notably, the *Canadian Guideline on Concussion in Sport* (57) included surveillance and documentation as an imperative portion of primary concussion prevention. However, very few documents outlined processes for mandatory reporting to medical officers or

penalties for non-compliance, limiting the enforceability of stated procedures (132, 136, 152). Most frequently, evidence included medical clearance forms as part of full integration back into sport. This inconsistency in documentation practices suggests variability in how injury surveillance and long-term athlete safety monitoring are operationalised across sporting contexts.

The feasibility of enforcement must therefore be interpreted in relation to governance structure and resource capacity. In professionalised sporting environments with regulated competition systems and contractual medical staffing, monitoring compliance may be realistically achievable. By contrast, in amateur environments, where athletes train independently, and medical coverage may be limited, compliance may be more challenging to systematically verify. In environments like this, compliance may rely less on formal standards, and more on education, sport culture norms, and voluntary cooperation. When considered alongside the qualitative findings in Chapter Three, where practitioners described relational pressures shaping decision-making, it becomes evident that compliance is a product of its environment.

4.7 Preventative Measures

This theme, represented by the figure below, explores the proactive strategies used across evidence to reduce SRC risk, highlighting variations in educational initiatives, rule changes, equipment recommendations, and targeted training interventions.

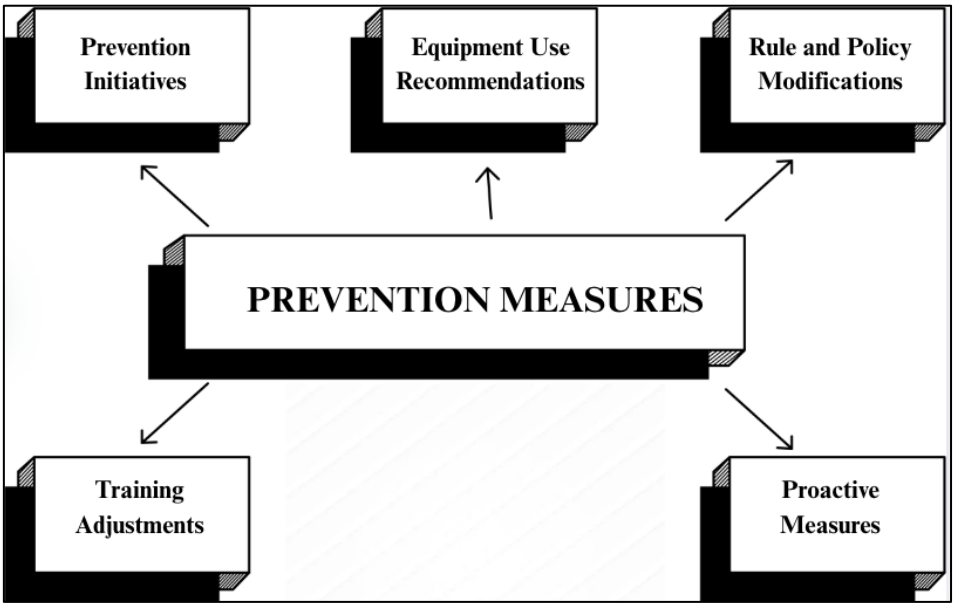

Figure 6: Top-level code two - prevention measures

4.7.1 Prevention Initiatives

Prevention initiatives were one of the more consistently addressed components across the included evidence, though the scope, delivery methods, and specificity of content varied considerably. Based on the traffic light grading, 64% (n=74) of documents were marked as "yes" for containing prevention content, while 34% (n=39) did not. An additional 2% (n=2) were marked as "other".

Most commonly, sources emphasized education (n=26) and general awareness as primary preventative tools. These initiatives were typically directed toward coaches, stakeholders, and support personnel, and often included general concussion recognition, symptom monitoring, and risk awareness. For instance, the NCAA mandates education for all student-athletes and team personnel, with signed acknowledgments confirming understanding of concussion risks (66). Similarly, Rugby Australia (126) and *Concussion in Sport Australia Position Statement* (41) documents promoted education as a collective responsibility, extending not only to medical staff but also to sport organisations, stakeholders, and athletes

themselves. Some organisations, such as South Africa Rugby, also developed supplementary visual materials and embedded video-based education modules to improve accessibility and engagement (62). However, the content and format of educational materials varied significantly. While a few sources included structured web resources for general education, such as Sports Concussion South Africa, others only referred broadly to the importance of awareness without specifying mechanisms to accomplish it (51). In some cases, education was suggested rather than mandated (52, 137). Overall, although educational prevention efforts were present in many sources, they differed in terms of depth, required participation, and mechanisms for evaluation or compliance. This variability highlights the need for standardized, audience-specific educational tools that go beyond general awareness and offer measurable outcomes tied to actual prevention strategies.

4.7.2 Equipment Use Recommendations

Specific recommendations regarding protective equipment were infrequently addressed across the reviewed sources and, when present, tended to vary considerably in strength of endorsement. Approximately 10% (n=12) documents were explicitly coded for including equipment recommendations. However, this number may underestimate overall representation, as some policy documents may assume compliance with standardised sport-specific equipment rules without explicitly restating them. Where included, equipment was generally acknowledged as a broad component of SRC prevention, though few sources provided enforceable or context-specific guidance. For example, the *Australian Cricket Concussion and Head Trauma Policy* (125) included explicit language around umpire helmet use, the fitting of neck guards, and helmet replacement protocols following an impact. Similarly, the *Canadian Guideline on Concussion in Sport (Parachute)* (57) noted that equipment modifications may be an effective primary prevention strategy, but emphasized

that such decisions should be informed by context-specific injury risks. USA Soccer's (77) position on equipment highlighted both the limitations and the potential of various approaches. While mouthguards were noted to have unclear benefit for concussion prevention, their use was supported for reducing facial and dental injuries (77).

Overall, the inclusion of equipment-focused strategies was limited. Many documents referenced the potential utility of equipment in reducing SRC risk but lacked direct recommendations. Though this is partially due to sport-specific needs, these gaps reflect a trend of caution in issuing equipment mandates without evidence and highlights the need for further evaluation of protective equipment.

4.7.3 Rule and Policy Modifications

Formal rule or policy modifications to support SRC recognition and athlete removal were relatively uncommon across the included evidence. Only 12% (n=14) of documents were explicitly coded as including gameplay-related rule or policy changes tied to SRC response or prevention. However, among this subset, a few sports introduced notable procedural adaptations that formally embedded concussion-specific decision-making into gameplay structures. Rugby Australia's *Blue Card* initiative (126) stands out as a clear example of a rule-based approach to SRC. Referees may issue a 'Blue Card' as a signal that a player is being removed due to suspected SRC. This cue also initiates formal documentation, reinforcing shared responsibility between match officials and medical staff (126). Similarly, in elite-level cricket, the England and Wales Cricket Board (55) and ICC (72) introduced concussion substitute regulations allowing players to be temporarily removed for sideline assessment, with medical approval required for any return. Other examples included

temporary suspension of play to enable assessment, as outlined in the *DFL's Head Injuries* guidance (118), and automatic suspension periods in boxing, where athletes who experience significant head trauma must undergo mandatory rest and medical clearance before RTP (149). Additionally, World Rugby (115) adopted a four-stage Head Injury Assessment (HIA) protocol integrating sideline observation, off-field testing, and follow-up assessments (HIA1–HIA4), supported by instrumented mouthguard data and video review, to standardise SRC management during elite matches. While these examples illustrate growing awareness of rule-based strategies, such gameplay structure modification remains uncommon. This suggests a missed opportunity to integrate concussion awareness into the formal structure of sport.

4.7.4 Training Adjustments

Training-related adjustments were the least frequently addressed prevention strategies across all the evidence. While often referenced in broader discussions of injury risk reduction, less than 3% of evidence (n=3) specified concrete modifications to training structure, contact exposure, or skill progression aimed at lowering concussion risk. Notably, the 6th CISG consensus statement (1) recommends neuromuscular training (NMT) warm-up programmes as an evidence-supported strategy. These programmes, when implemented three times per week, were associated with a lower rate of SRC across age groups (1). Similarly, the *Canadian Guideline on Concussion in Sport* (57) outlined training adjustments as one of several prevention strategies. This included potentially limiting contact during practices and NMT warm-up programmes based on sport-specific contexts (57). Interestingly, while World Rugby (115) published standalone recommendations limiting full contact training to 15 minutes per week, this guidance was not included in its concussion-specific guidance

documents. Overall, although training environments were recognised as sites of preventable risk, few protocols articulated specific or enforceable adjustments to practice design.

4.7.5 Proactive Measures

Proactive strategies, such as pre-season baseline testing, emergency action plans (EAPs), and concussion-specific personnel, were not consistently or explicitly addressed across the evidence base. These practices aimed to support early recognition, streamline emergency response, and enable more consistent decision-making in post-injury care, but their level of detail, implementation guidance, and uptake varied.

Of the included sources, 36% (n=41) were coded as recommending or mandating baseline testing. These protocols were more commonly observed in elite settings. For instance, the DFL requires pre-season neurological baseline screening for all players in top-tier football clubs, using tools such as SCAT and clinical assessments (118). Similarly, FIBA (85) and the NFL (101) mandate comprehensive baseline evaluation for all players, incorporating both physical and neuropsychological components. Other documents, including those from USA Lacrosse (119) and Cycling Canada (73), encourage or 'advise' for baseline testing but framed it as optional or resource-dependent.

EAPs were referenced less frequently, appearing in only 10% of sources (n=11). Where present, EAPs emphasised pre-planned communication protocols and sideline coordination. FIFA's Pre-Match EAP, for example, emphasized emergency readiness, proactive communication protocols, and pre-determined on-field response procedures (56). The NFL's EAPs went further, requiring formal documentation, trauma centre coordination,

and designated personnel (81, 101). While these examples reflect high resource environments, such protocols were largely absent from non-elite organisations.

Designated concussion personnel behaving as a proactive strategy appeared within less than 5% of evidence (n=5). Sports Medicine Australia encouraged the designation of a "Concussion Coordinator" to oversee protocol implementation and communication (78). Similarly, the NFL Head, Neck, and Spine Committee (81) included "Unaffiliated Neurotrauma Consultants" (UNCs) and "Booth Certified Athletic Trainer Spotter's" as embedded sideline roles during games to identify possible injury or SRC. Despite these emerging practices, proactive measures remain inconsistently discussed within SRC policy and protocols. Where present, they were often limited to elite settings, with few documents offering implementation guidance applicable across varied sporting levels and environments.

4.8 Sideline Evaluation and Diagnosis

This theme focuses on how SRC is identified in real time, analysing the presence, specificity, and clarity of sideline protocols, recommended assessment tools, and clinical thresholds guiding removal and referral decisions. The figure below illustrates the major theme and sub-themes related to it.

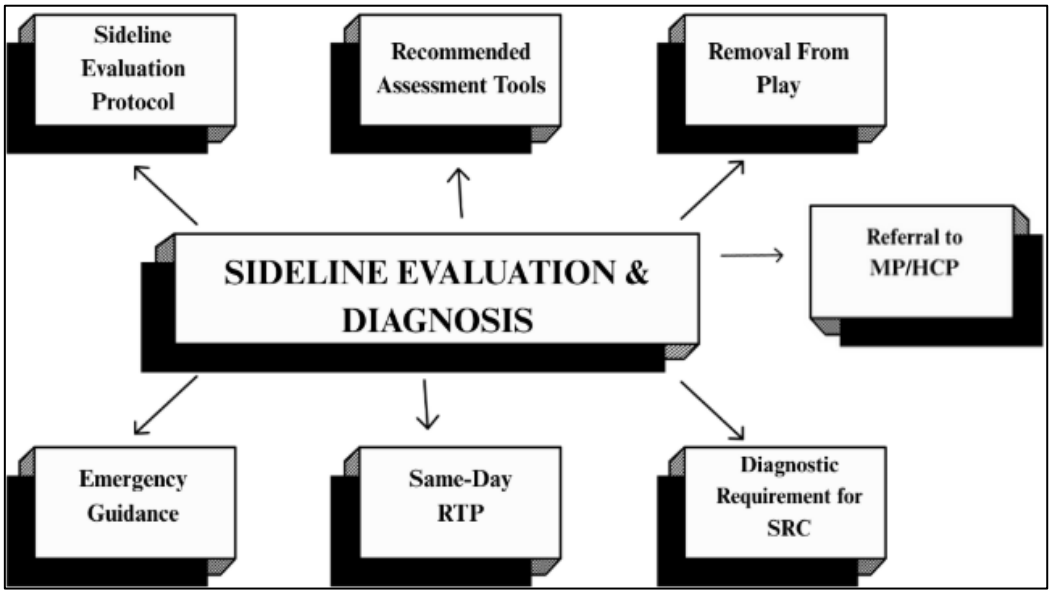

Figure 7: Top-level code three - sideline evaluation and diagnosis

4.8.1 Sideline Evaluation Protocol

Sideline evaluation protocols were consistently included across the evidence, with some notable differences in clarity, comprehensiveness, and implementation depending on the sport and competition level. While some high-performance sport guidelines provided detailed, stepwise evaluation protocols incorporating standardized tools and multidisciplinary assessments, others lacked explicit procedures, made only general reference to SCAT guidance, or deferred to broader medical oversight without sport-specific direction. As shown below in Figure 9, 77% (n=89) of documents included some form of sideline evaluation, while 17% (n=19) did not. An additional 6% (n=7) were “other”, reflecting indirect or ambiguous inclusion.

A strong example of this includes the *England Cricket Professional and Elite Academy Concussion Guidelines* (55), which outlined structured sideline evaluation processes utilizing the SCAT6, mandated medical assessments, and potential video review to support diagnosis. Similarly, the work of Tarzi et al. (124) demonstrates a need for proper enforcement and assessment when acutely addressing the injury field side. Equestrian

Ireland's (129) guidelines provided a bullet-point adaptation, including brief sideline information such as the use of Maddock's Questions modified for equestrian sport, along with reassessment timelines to prompt medical assistance. The following figure illustrates a generalised SRC pathway, constructed from components identified across select high-performance policies and guidelines.

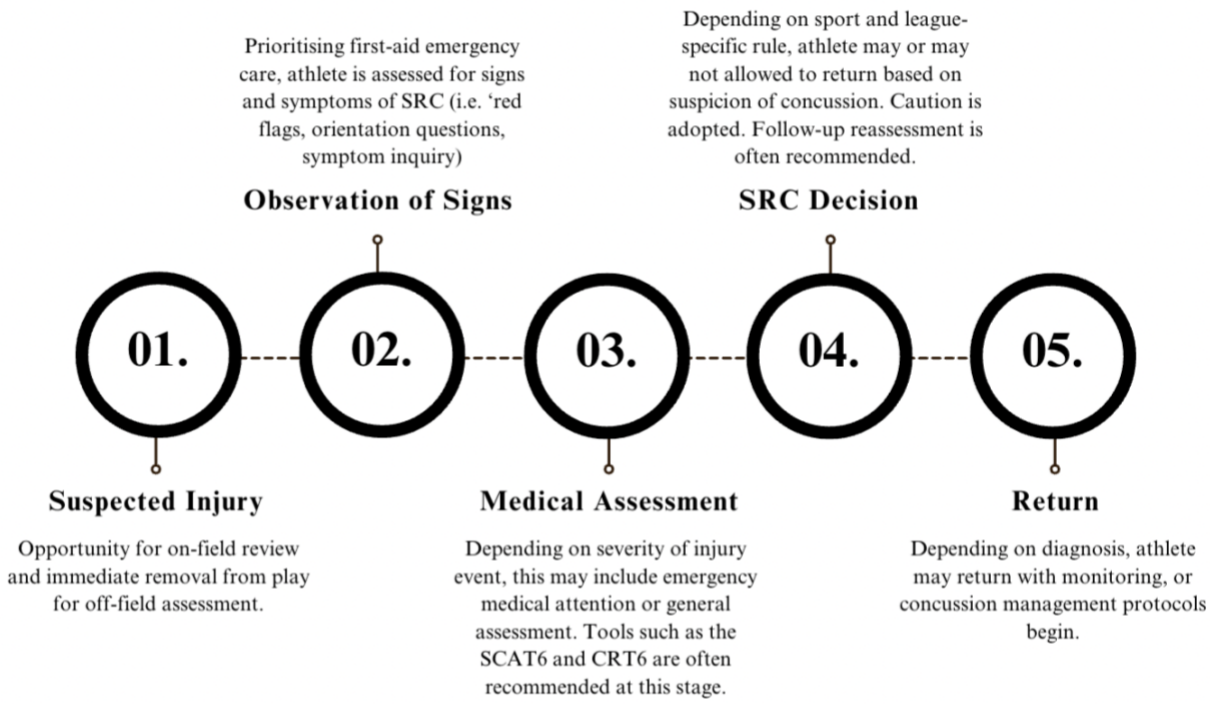

Figure 8: Generalised concussion pathway example

In contrast, several guidelines, such as the *Strategic Plan for SRC in Australian Football* (121), focused broadly on education, prevention, and shifts toward safety but offered no explicit sideline evaluation protocol for real-time injury management. The *FIVB Concussion Protocol* (140) even neglects to include sideline protocols, and rather casts focus on RTP strategies. Even where sideline assessment was acknowledged, the guidance often lacked specificity regarding who should conduct assessments, what tools were recommended, or what thresholds triggered removal or further evaluation. While many sources included sideline evaluation components, the depth and focus of coverage varied considerably. Some

documents labelled as 'concussion guidance' or ‘protocols’ focused exclusively on post-injury management, while others encompassed the full injury timeline, from recognition and assessment to RTP, therefore making it difficult to compare practices or establish consistent expectations.

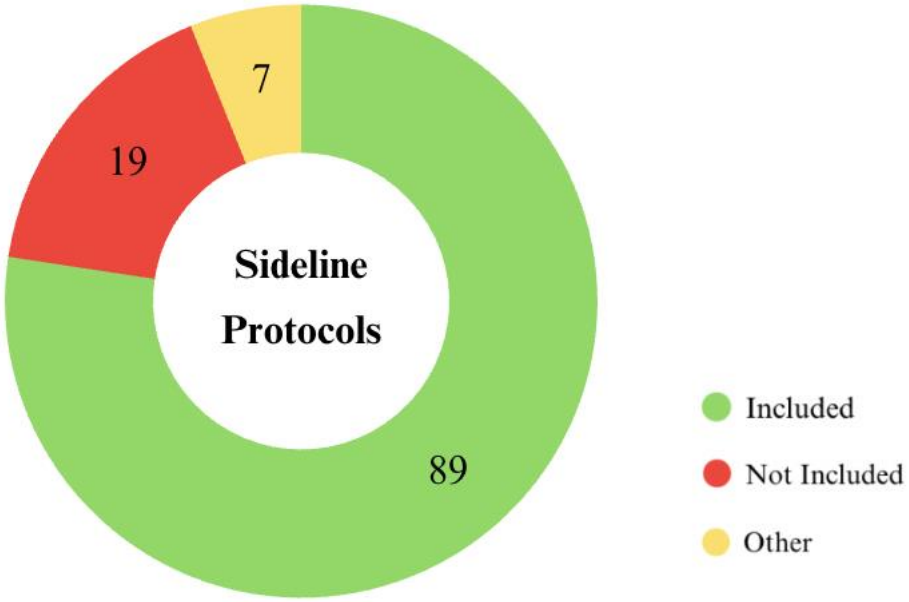

Figure 9: Frequency of sideline protocol inclusion across evidence

4.8.2 Recommended Assessment Tools

A wide range of assessment tools were referenced across the evidence base, with notable variation in their target users and recommended contexts. The Sport Concussion Assessment Tool (SCAT)**,** in its various versions, was the most frequently cited standardised tool, appearing in 65% (n=75) of included documents. It was most recommended for use by trained HCP to aid sideline evaluation, symptom monitoring, and follow-up assessments. Examples of SCAT use included its integration into protocols for Volleyball Canada (89), Basketball Australia (59)**,** England Cricket (55), and the ICC (72), where SCAT6 was identified as an important tool to aid clinical assessment for SRC. Some guidelines, such as

those from Taekwondo Canada (70) and British Judo (91), explicitly include SCAT usage within medical suspension forms, using serial assessments to guide performance progress. Across these sources, SCAT was generally framed as a healthcare-administered tool valid for use within the acute post-injury window.

Though less frequent, other assessment tools were included in certain contexts. The Concussion Recognition Tool (CRT), designed for use by non-medical personnel to aid recognition of suspected concussion, was referenced in 35% (n=40) of the evidence. Evidence from British Equestrian, Canada's *Parachute*, and several Australian sport codes incorporated the use of CRT (57, 59, 60, 90, 122). Combat sports guidelines, such as those from AIBA (152), referenced the Glasgow Coma Scale (GCS) as a rapid neurological evaluation tool, particularly in emergency settings. Additionally, sport-specific adaptations, such as the proposed RIDE assessment for downhill mountain biking (DHI) in the work of McLarnon et al., were highlighted as niche evaluation strategies (120). Despite the dominance of SCAT, the evidence reflected considerable variability in assessment tool recommendations across sports and levels of play. While professional and elite sport contexts tended to specify structured tool requirements and formal assessments, such guidance was often minimal in generalised or community-level guidelines.

4.8.3 Removal from Play

Removal from play following a suspected SRC was a widely endorsed recommendation across the evidence base; however, the mandatory nature and enforcement of removal policies varied across sports, competition levels, and organisational guidelines. Of the documents included, 76% (n=88) explicitly mentioned athlete removal procedures following suspected concussion. While many high-performance sport guidelines articulated

clear criteria requiring immediate removal from participation, others left removal decisions to the discretion of medical staff or provided vague recommendations without enforceable thresholds.

Several elite sport guidelines specified mandatory removal based on the presence of key clinical signs or symptoms. For example, the ICC (72) identified signs such as loss of consciousness (LOC), seizure, tonic posturing, ataxia, disorientation, or a dazed appearance as sufficient to trigger immediate removal and exclusion from further participation until medical clearance was obtained. Similar explicit removal criteria were found in many guidelines, including the *International Ice Hockey Federation (IIHF) Concussion Protocol* (148), which mandated that any player displaying concussion signs or symptoms must be removed from the playing environment as soon as possible by medical staff (61, 68, 128, 148).

In contrast, some guidelines provided more ambiguous or discretionary removal recommendations. The *Australian Cricket Concussion and Head Trauma Policy* (125) described specific high-risk mechanisms (e.g., impact to the back of the helmet with rebound) but did not mandate removal in all such cases, instead advising medical personnel to “err on the side of caution”. Similarly, AIBA (152) noted that if a boxer appeared stable (no knock-out) with no major symptoms, a “quick concussion assessment” could permit the athlete to continue competing. These examples reflect contexts where competition structure or sport-specific demands may influence medical decision-making thresholds. Although removal from play was a near-universal concept across guidelines, lack of mandatory enforcement mechanisms or clearly defined criteria poses potential issues.

4.8.4 Referral to MP/HCP

Across the evidence, referral to a qualified healthcare professional (HCP) was widely supported as an essential component of post-sideline concussion management. Approximately 45% of the included sources (n=52) explicitly recommended referral to an HCP beyond initial or emergency care. Many guidelines emphasized that suspected SRC cases should be evaluated and managed only by a credentialed medical professional (MP) with experience in concussion care (72, 92, 105, 121). Hockey Australia (60) and England Football (64) guidelines also reinforced that athletes must be referred for professional medical assessment at the earliest opportunity. While the need for medical referral was consistently acknowledged, it was rare to observe specific steps or provider types involved in the referral process. This may reflect the context-specific nature of medical pathways across sporting environments, where logistical factors vary between leagues and countries.

4.8.5 Emergency Guidance

Emergency guidance in the event of a suspected severe head or spinal injury was included in many reviewed documents, though it was often embedded within broader sideline protocols or first aid references rather than outlined in a standalone section, as discussed in section 4.8.1. Of the included evidence, 31% (n=36) incorporated emergency guidance procedures, and 32% (n=37) made explicit mention of “red flag” symptoms. Where addressed, emergency procedures typically emphasized the importance of recognising red flag symptoms, such as loss of consciousness (LOC), convulsions, worsening headache, vomiting, or neck pain, as indicators for immediate referral to emergency services.

The majority of documents, including those from Parachute (57), USA Lacrosse (119), and Lacrosse Canada (61), urge emergency medical attention or use of an EAP when

red flag symptoms are present. These sources referenced the CRT6 as a framework to guide non-medical personnel in identifying ‘red flag’ signs that may indicate urgent intervention. In others, such as Motorsport Australia (151) and the Australian Institute of Sport (41), emergency evaluation followed structured trauma assessment pathways and included criteria (based on SCAT) for urgent transport based on observable signs and spinal injury risk. Overall, while not universally included, emergency guidance was present in sources, with consistent emphasis on prompt recognition, appropriate activation of emergency protocols, and the prioritisation of athlete safety in severe injury scenarios.

4.8.6 Same-Day RTP

Same-day RTP following a suspected SRC was addressed in many of the reviewed documents, with the majority adopting a conservative approach that prohibits immediate return unless SRC was definitively ruled out. Of the included sources, 58% (n=67) were coded as explicitly prohibiting same-day return for athletes suspected of SRC. These policies typically reflected evolving best practices in concussion management, prioritising athlete safety and symptom monitoring over rapid re-entry. Strict no-RTP policies were articulated in guidelines from the IIHF (148), NHL (109), Motorsport Australia (151), and the NFL (101, 116), amongst others. These sources explicitly stated that any athlete with a diagnosed or suspected SRC must not return to competition on the same day, regardless of apparent improvement. In some cases, such as Motorsport UK (136), competition licences were immediately suspended following suspected concussion, and documentation was submitted to the governing body for further approval. However, a few guidelines allowed for a conditional same-day return if a SRC was ruled out by a qualified HCP. For example, the ICC (72) and England Cricket (55) permit an athlete to RTP after a quick sideline assessment if no SRC was diagnosed, though England Cricket specifies follow-up SCAT6 testing later that day.

Canada Soccer (102) and Baseball Canada (99) included similar guidance, stating that if no symptoms or signs were present, and a qualified MP/HCP determined no SRC had occurred, the participant could RTP with ongoing monitoring. Overall, the trend across the evidence strongly discourages same-day RTP following suspected SRC.

4.8.7 Diagnostic Requirement for SRC

Evidence that included information on SRC diagnosis emphasized that only appropriately qualified HCP should be responsible for confirming or ruling out a SRC. This distinction was consistently linked to the evolving nature of concussion symptoms and the limitations of on-field tools when used in isolation. Of the reviewed evidence, 31% (n=36) were coded as explicitly referencing diagnostic requirements or criteria for confirming SRC. For example, Softball Canada (52) and Sports Medicine Australia (78) both stated that suspected SRC must be followed by formal medical assessment and that written clearance should be provided before RTP. Similarly, Sport Singapore (82) directed non-medical personnel, such as coaches, to refer suspected cases to an HCP rather than attempting to assess the injury themselves. These documents also emphasized that not only immediate signs and symptoms should be considered for diagnosis, but also delayed onset indicators and prior injury history. Nonetheless, the reliance on professional medical judgment was positioned as a cornerstone of safe concussion management in most of the evidence reviewed.

4.9 SRC Management Strategies

This theme, depicted in the figure below, investigates the protocols governing athlete recovery and RTP, including the structuring of RTP stages, recovery timelines, and the necessity of medical clearance, and differences within high-performance contexts.

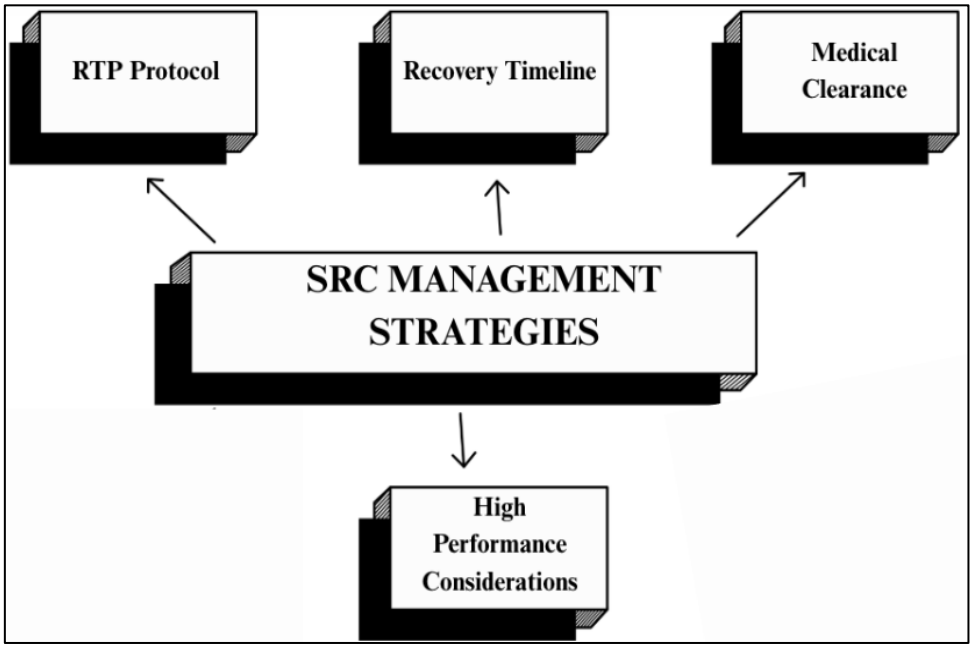

Figure 10: Top-level code four - SRC management strategies

4.9.1 RTP Protocol

RTP guidance was among the most consistently addressed elements across the evidence base, particularly within structured SRC policies and high-performance sport frameworks. Of the documents reviewed, 85% (n=98) included a formal RTP protocol, while 12% (n=14) did not. These frequencies are summarised in Figure 11.

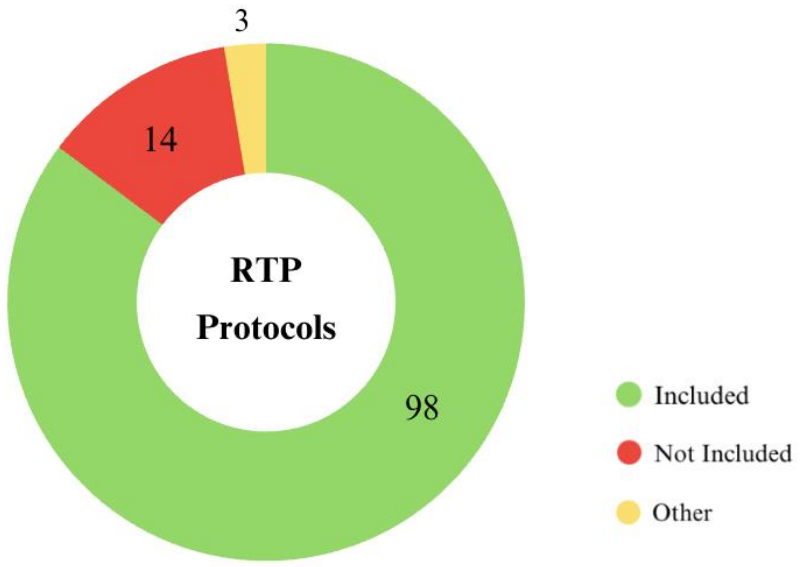

Figure 11: Frequency of RTP protocols in evidence

Most protocols adhered to a general progression model underpinned by symptom resolution, functional milestones, and staged physical reintroduction. Although structure, terminology, and timing varied, a five- to six-step progression model was commonly observed. This structure closely mirrors frameworks developed by the Concussion in Sport Group (CISG), which informed many of the included protocols. Notably, the 6th CISG consensus statement advocates for a symptom-guided, step-based approach, where each stage should take a minimum of 24 hours with close monitoring of symptom recurrence (1). A full summary of the evidence and respective RTP protocols is available within Appendix IX. A general RTP progression seen across evidence is summarized as follows:

- **Step One: Symptom-limited activity**
  - Relative rest, avoidance of intense cognitive and physical stressors.
- **Step Two: Light aerobic exercise**
  - Low-impact, non-contact movements (e.g. walking, cycling).
- **Step Three: Sport-specific drills**
  - Introduction of individual training elements without risk of impact.
- **Step Four: Non-contact training**
  - Reintegration into team environments where applicable. Resistance training permitted.
- **Step Five: Full contact practice**
  - Typically requires medical clearance.
- **Step Six: Return to Competition**
  - Only after clearance and symptom-free at all stages.

This model was particularly evident in sources such as Canada Soccer (102), Football Australia (127), and U.S. Soccer (77), all of which required medical clearance prior to return to full-contact practice or competitive play. Interestingly, some sources offered modified or enhanced care pathways (e.g., England Football "Enhanced Care" pathway, World Rugby "Advanced Care" Pathway) that included intensive monitoring for athletes under high-performance medical care so that athletes may be considered for an earlier RTP (64, 115). These RTP protocols are generally consistent in terms of progressive stages, but reflect differing timelines for progression, criteria, and requirements for medical oversight. While nearly all protocols shared a foundation of graded RTP, implementation and wording varied.

4.9.2 Recovery Timeline

Recovery timelines following SRC were addressed in many of the reviewed documents, though recommendations varied depending on sport type, level of competition, and the underlying RTP model. Of the included evidence, 59% (n=68) made some mention of a recovery timeline. Within this group of 68, 56 sources included timelines for RTP stage

progression (e.g., 24-hour minimum increments between stages), while 27 provided an overall minimum recovery timeline. Some protocols included both timeline types, others only one, and a few used vague or implied guidance that complicated classification. This variability reflects both sport-specific needs and broader inconsistencies in how recovery expectations are communicated.

Combat and contact sports, such as AIBA (152)**,** World Taekwondo (159), and Australian Karate (88), commonly imposed mandatory rest or suspension periods following head impacts or confirmed concussions. These ranged from 21 days for first-time SRC to up to six months for athletes experiencing prolonged LOC or multiple SRC in a short timeframe (88). Similarly, Motorsport UK (136) and New Zealand Ice Hockey Federation (NZIHF) (138) mandated minimum suspension periods of 21 days or longer before athletes could resume activity, often requiring documentation from medical professionals before re-entry.

In contrast, sports such as Basketball Australia (59), Softball Canada (52) **,** and CASC (132) framed recovery as symptom-guided and variable, with clinicians advised to tailor RTP progression to individual athlete response. Some sources, including the NRL (93), did not define minimum total recovery periods but included minimum rest durations by structuring their RTP protocols with 24-hour stage increments. Although consensus was strong that athletes must be symptom-free before resuming contact activity, the variations in recovery expectations, standardized timelines, and individualized care models, may add to confusion within SRC care.

4.9.3 Medical Clearance

Medical clearance before returning to full-contact sport was explicitly required in many of the reviewed guidelines, particularly those aligned with structured RTP protocols. Of the included sources, 67% (n=77) included medical clearance as a required or strongly recommended component of the RTP process. Most commonly, clearance had to be obtained from a medical doctor or nurse practitioner, often in the form of a written statement or letter confirming the successful completion of recovery stages and clinical assessment. Policies from Volleyball Canada (89), NZ Football (128), World Lacrosse (154), and Baseball Canada (99) all required formal medical clearance, typically before progressing to high-risk activity such as full contact or match play. Several documents also noted that clearance decisions should be made based on a combination of symptom resolution, medical history, and clinical judgment, sometimes incorporating additional tests such as neuropsychological assessments (i.e. SCAT). Some guidelines (e.g., British Wrestling, UCI) did not explicitly require medical clearance requirements but advised symptom monitoring, gradual stage progression, and medical diagnosis to confirm SRC (123, 137). In other cases, the requirement for clearance was implied but not clearly operationalized within the protocol structure. Overall, while medical clearance was a widely supported principle in SRC management, the specificity and enforcement of this step varied.

4.9.4 High Performance Considerations

A small number of reviewed documents (n=3) included specific considerations for high-performance or professional athlete settings, often describing enhanced SRC management pathways available only under certain medical and institutional conditions. These pathways permit accelerated RTP timelines, contingent on access to additional medical supervision, baseline data comparison, and clinical input. Guidelines from World Rugby

(115), England Football (64), and *Concussion Guidelines for Basketball in Great Britain* (107) provided the clearest examples of this enhanced model. These policies required that athletes be under the direct care of medical doctors with specialized concussion training and access to a multidisciplinary team (64). In these settings, shortened RTP timelines were permitted only when rigorous monitoring, serial assessments and documented recovery to individual baselines had occurred. These high-performance pathways were explicitly limited to elite contexts, with documents cautioning that such approaches were not appropriate for youth athletes or general sport settings. Enhanced care frameworks also emphasized the importance of formal clearance prior to return, reinforcing that acceleration of timelines must not compromise safety.

4.10 Follow-Up Care and Prognosis

This theme, depicted in the figure below, considers how long-term care is addressed post-concussion, with a focus on the management of persistent symptoms and the integration of multidisciplinary referral pathways in SRC protocols.

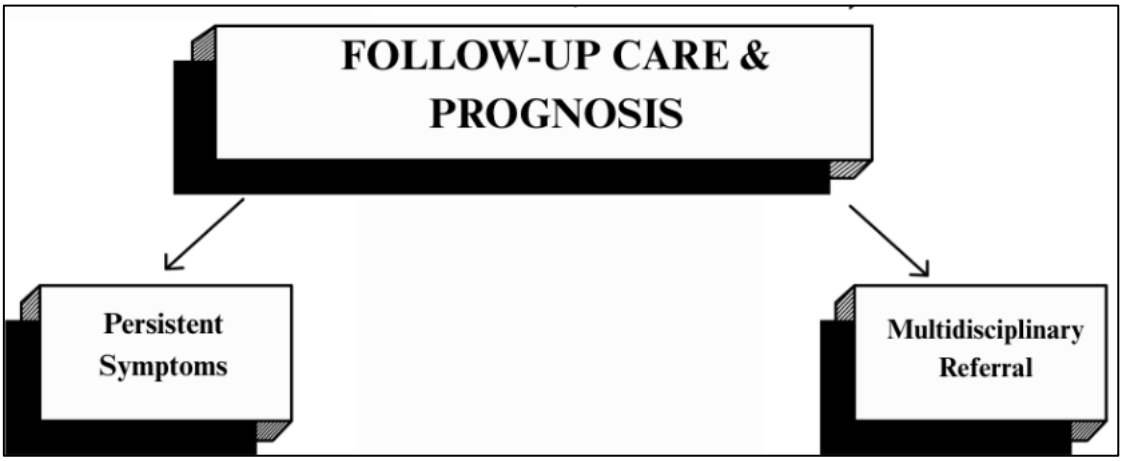

Figure 12: Top-level code five - follow-up care and prognosis

4.10.1 Persistent Symptoms

Persistent or prolonged SRC symptoms were mentioned in a subset of the reviewed evidence, though detailed management protocols were not consistently provided. Of the 115 sources, 27% (n=31) acknowledged the potential for symptoms to persist beyond the typical recovery period. Most sources noted that while many athletes recover within 2–4 weeks, a smaller proportion experience symptoms that extend beyond this timeframe (74). Several documents, including those from Volleyball Canada (89), British Cycling (65), and Karate Australia (88), recommended that individuals with symptoms persisting longer than the expected window be referred to a MP or SRC specialist. These sources also emphasized more conservative RTP timelines for athletes with multiple SRC or other confounding factors. The 6th CISG consensus statement from Amsterdam acknowledges that persistent symptoms may require multimodal clinical assessment and specialist care, especially when considering long-term outcomes from contact sports (1). Many pieces of evidence included brief suggestions of specialist referral, such as British Equestrian's guidance (90), but did not outline structured follow-up expectations. Overall, although recognition of persistent symptoms was present, very few documents provided detailed protocols for long-term symptom management.

4.10.2 Multidisciplinary Referral

Of the 115 sources, 14% (n=16) included guidance recommending referral to interdisciplinary care teams or professionals with specialised SRC expertise. These referrals typically included direction towards HCP with SRC expertise or specialized clinics that offer interdisciplinary care, when symptoms were prolonged. FIBA (85), Basketball Australia (59), and Lacrosse Canada (61) all outlined circumstances in which referral to a neurologist, sports medicine physician, or other SRC specialist would be appropriate. An academic review of Canadian concussion care pathways additionally highlighted the role of chiropractors and

physiotherapists within an interdisciplinary framework, emphasizing coordination across multiple disciplines depending on symptom presentation and resource availability (53). While referral to multidisciplinary pathways were not uniformly present across all documents, the inclusion of specialist referral options in guidelines reflects the evolving role of interdisciplinary care in non-routine recovery trajectories.

4.11 Limitations and Future Directions

Though scoping reviews are comprehensive in nature, several limitations apply to this methodology. As outlined by JBI guidelines, scoping reviews aim to map available literature based on broad inclusion criteria, meaning that these reviews often map evidence breadth rather than depth (30). Despite using the PRISMA framework to enhance transparency, the screening and selection process was still filtered through the perspective of a single research team. Although no disagreements occurred during screening, this inherent subjectivity reinforced the need for continued researcher reflexivity throughout.'

This study also encountered practical limitations, particularly regarding the accessibility and completeness of available data. The evidence base was limited to publicly available sources, which may not reflect the full scope of existing SRC protocols. Some countries may have unpublished, regional, or sport-specific guidelines that were not captured due to restricted access, language barriers, or lack of documentation. Importantly, the absence of evidence does not necessarily indicate the absence of a protocol. Sports governed by multiple federations, such as MMA (e.g., BRAVE Combat Federation, UFC), posed challenges, as did international bodies like the Fédération Internationale de l'Automobile

(FiA), which oversee the respective sports globally but provide limited detail on country-specific implementation. Language barriers and inconsistent website navigation also hindered retrieval efforts, occasionally leading to translation inaccuracies or missing documents. Additionally, the review focused intentionally on mainstream, high-risk contact and combat sports. Niche or less globally prominent sports were excluded to maintain scope and comparability. Future research should seek to expand sport and regional representation and explore strategies to overcome access limitations, thereby supporting a more complete understanding of global SRC management practices.

4.11.1 Additional Considerations

In addition to the limitations, this review involved interpretive considerations arising from heterogeneity and inconsistency across the evidence base. Ambiguity was particularly evident in how SRC was defined and operationalised across documents, with many policies lacking explicit definitions all together. Similar variability was observed across key domains such as prevention strategies, sideline evaluation procedures, thresholds for removal from play, and follow-up care, where guidance ranged from prescriptive protocols to indirectly referenced recommendations.

These ambiguities reflect both the evolving understanding of SRC and the reality that concussion represents a clinical syndrome rather than a uniform pathology. As outlined by Sharp and Jenkins (2015), SRC lacks a clear pathological definition and has historically been used as a broad label applied to a cluster of symptoms (28). Rather than being seen as an error, the above ambiguity was approached as an analytically meaningful finding within the

literature. This absence of a definitive pathological boundary contributes to ongoing variability in how SRC is defined, classified, and operationalised across contexts (28). Reflexive engagement was supported through collaborative discussion with the supervisory team, particularly when determining how concepts should be categorised, contrasted, or synthesised without over-simplification. Supervisory input was instrumental in refining thematic boundaries while ensuring that the research remains analytically coherent. Reflexive engagement with these ambiguities, supported through collaborative discussion with the supervisory team as outlined earlier in this chapter, informed how such variability was synthesised and represented.

4.11.1.1 Contextual Fit and Resource Considerations

Beyond methodological considerations, the appropriateness of existing SRC guidelines must be interpreted in relation to the contexts in which they are intended to operate. Many of the included pieces of evidence assume access to trained HCP, diagnostic tools, and resources that are more readily available in elite or well-funded sporting environments. As discussed in Section 4.6.3, target audience differentiation was frequently unclear. In contrast, non-elite settings may lack consistent medical coverage or enforcement mechanisms, limiting the feasibility of implementing highly prescriptive guidance. Some documents appear to outline best-practice medical standards, aligned with consensus statements, while others may be simplified due to constraints in implementation. Target audience alignment further shapes applicability. Several documents blended clinical guidance with general educational messaging for coaches, administrators, and healthcare professionals within a single resource. While this approach may seem to increase accessibility, it risks obscuring the scope of

practice. When expert-level instruction is presented without differentiation, non-medical stakeholders may interpret themselves as responsible for SRC decisions.

Additionally, limited adaptation across age groups or between gender populations suggests that some guidance is presented as universally applicable despite known differences in risk profiles, symptom presentation, and recovery trajectories (163). Evaluating SRC guideline quality, therefore, requires consideration not only of alignment with consensus recommendations, but also of sport context, resource availability, and audience appropriateness. These factors are central to determining whether existing guidance is truly fit for purpose across diverse sporting environments.

4.12 Chapter Conclusion

This scoping review examined 115 documents from 22 sports across a mix of national and international organisations to explore how SRC is defined, managed, and operationalized in formal policy. Using a structured coding approach, five key domains were identified: *Purpose and Scope*, *Prevention Measures*, *Sideline Evaluation and Diagnosis*, *SRC Management Strategies*, and *Follow-Up Care and Prognosis*. Findings revealed wide variability across all domains. RTP procedures and compliance requirements ranged from clearly defined to entirely absent, while target audiences, including HCP, athletes, and general stakeholders, were often intertwined, leading to communication challenges. Preventative strategies frequently emphasized education but were applied inconsistently and rarely included enforceable components. Follow-up care, particularly for persistent symptoms, was one of the least consistently addressed areas, often omitted entirely or vaguely described. Critically, inconsistencies in definitions, protocol structure, and enforcement mechanisms persist across sports. As a result, athletes remain vulnerable to

miscommunication, varying RTP standards, and suboptimal recovery pathways. Moving forward, this review highlights the need for clear, operational definitions of SRC, standardised RTP and sideline evaluation protocols, differentiation of target audiences, and sport-specific enforceable SRC management strategies. Without global standardisation and stronger compliance, SRC policy will continue to fall short of safeguarding athlete health.

CHAPTER THREE: Medical Professionals' Approaches to Sport-Related Concussion Management Amongst High-Performance Athletes: A Qualitative Study

Abstract

Background: Despite the widespread recognition of SRCs as a significant issue in high-performance sports, inconsistencies persist in their definition, diagnosis, and management. This study aims to explore the current approaches and attitudes of medical and healthcare professionals (MP/HCP) working with high-performance athletes towards the diagnosis, treatment, and management of sport-related concussions (SRCs).

Methods: This qualitative study used semi-structured interviews with six medical professionals: four physiotherapists and two sports therapists, each involved in SRC management within high-performance sport. Participants had between 1 and 36 years of professional experience (mean ≈ 14.75 years). All were certified by relevant professional bodies. Reflexive thematic analysis was applied to examine how existing SRC protocols and consensus statements inform real-world decision-making and clinical care.

Findings: Four major themes were identified: (1) barriers to effective SRC management, (2) practitioner confidence, (3) varied SRC definitions and understanding, and (4) inconsistency within care delivery. Participants described SRC as a complex and often misunderstood injury, with care shaped by institutional structures, interpersonal dynamics, and prior experience.

Conclusions: This study highlights a persistent gap between SRC guidelines and clinical implementation. Findings suggest a need for adaptable, education-driven strategies and more consistent guidance to support safer concussion management in elite sport.

Key Words: Sport-related Concussion, Guidelines, Management, Protocol, Practitioner

Section 5 - Qualitative Study

5.1 Background and Rationale

SRCs are widely acknowledged as complex, multifaceted injuries, yet their real-world diagnosis and management remain full of uncertainty (164). While groups such as the CISG have developed internationally recognised consensus statements aimed at unifying SRC care, translation into clinical practice remains inconsistent (1). Similarly, classification frameworks like those proposed by the American Congress of Rehabilitation Medicine (ACRM)(4) have helped define SRC within the broader category of mTBI, but their adoption across sports settings varies significantly.

The rapid evolution of operational definitions and understandings of SRC has created confusion and inconsistencies between and within organisations and sporting bodies. Disputed definitions further contribute to challenges in acute assessment and treatment, fostering uncertainty among practitioners in the field (28). The National Institute for Health and Care Excellence (NICE) (141) has also published guidance for head injury assessment, yet these documents often lack sport-specific detail or enforceability. Consequently, clinicians working with athletes must navigate a landscape of fragmented policies, institutional pressures, and limited diagnostic certainty. As highlighted by Stern et al. (13), even when protocols exist, their implementation can be compromised by contextual pressures, including organisational culture, perceived athlete readiness, and unclear RTP thresholds. Similarly, Yorke et al. (165) note that despite access to SRC protocols, HCPs often interpret and apply them differently based on training, sport-specific demands, and prior experiences.

In response to these challenges, this qualitative study examines how HCP working in elite sport settings engage with SRC guidance in practice. It explores their confidence, challenges, and decision-making processes, with the aim of identifying areas of disconnection between policy and application. Building on the system-level findings of the accompanying scoping review, this project offers a practitioner-focused lens on SRC management and generates applied insights to strengthen the translation of policy into real-world care.

5.2 Aims

This study aimed to:

- Explore how HCP perceive, implement, and share SRC guidelines in high-performance sport settings
- Identify barriers and facilitators that influence the translation of SRC information into practice
- Investigate areas for improvement in current approaches and generate strategies for enhancing SRC management going forward

Section 6 - Methods

6.1 Research Design

This qualitative study explored the attitudes and approaches of medical professionals involved in managing SRCs in high-performance contexts. Grounded in an interpretivist paradigm, it sought to understand the lived experiences and subjective meanings ascribed to SRC care by these professionals (21, 166). Semi-structured interviews were selected for their flexibility and capacity to elicit in-depth, participant-led narratives while still aligning with

the study's aims (167, 168). This method combines pre-determined questions with adaptability, allowing discussions to evolve based on participants' responses (168, 169). Such flexibility enables the emergence of new insights and richer data as conversations naturally evolve, enabling more nuanced data collection. Furthermore, this method proved valuable for capturing detailed, individualized perspectives, ensuring that each participant could share their insights without external influence (43).

Interviews were conducted online via video conferencing platforms (i.e., Zoom) to accommodate participant availability and geographic distribution. Each participant was given the option to engage in in-person, online, or focus group interviews; however, all opted for one-on-one digital interviews due to convenience and scheduling flexibility. All sessions were led by the primary researcher and lasted 30–60 minutes. They were audio-recorded, transcribed verbatim, and anonymised for analysis.

6.1.1 Positionality and Data Generation

The researcher entered data generation as a disciplinary insider to sport and health sciences, having progressed through undergraduate study in kinesiology and sociology into postgraduate study and research assistant roles. This background afforded familiarity with SRC discourse and sporting environments, facilitating shared academic language in interviews. However, the researcher had not previously led qualitative research, positioning them as a developing scholar within the academic hierarchy. This positioning shaped interview interactions: participants often interacted with the researcher as a knowledgeable but early-career academic. Reflexive awareness of this positioning informed the deliberate use of open-ended questions and active listening throughout data generation.

6.2 Participant Recruitment

Participants were recruited through a combination of purposeful sampling and snowball sampling to identify individuals best suited to the study's aims (170, 171). This sampling strategy was designed to represent a range of allied HCP working within the field of SRC. Initial recruitment was facilitated through the University of Essex's institutional networks, supported by the supervisory team and the University's official social media outreach. Snowball sampling was then employed to allow enrolled participants to recommend others who met the research's inclusion criteria, thereby expanding the recruitment pool in a targeted and efficient manner (171). Recruitment materials, including an invitation email and information flyer, were shared via LinkedIn, Instagram, and Facebook, targeting both clinical and academic networks. These materials clearly outlined the study's purpose, methodological approach, and inclusion criteria.

A detailed participant information sheet was provided to all potential participants, outlining the study's aims, procedures, and ethical considerations (see Appendix X). Communication channels were kept open to address inquiries and provide additional clarity when needed. Once interest was confirmed, all potential participants were screened against predefined inclusion and exclusion criteria. Eligible individuals were formally invited to participate, and interview arrangements were made collaboratively to ensure flexibility and participant comfort. This systematic and multi-faceted recruitment approach not only supported participant diversity but also ensured that participants aligned with the study's objectives and methodological requirements.

6.3 Participant Criteria

For the purpose of this study, “high-performance athletes” were defined as individuals competing within structured elite, semi-professional, academy, or national-level sport environments. “Experience” was operationalised as current or recent clinical involvement in providing care within such performance settings.

6.3.1 Participant Inclusion Criteria

- Medical professionals who have worked or are currently involved in SRC management (e.g. physiotherapists, general practitioners, sports therapists, athletic therapists, nurses, neurologists, etc.).
- Certified by the Health and Care Professions Council (HCPC) or an equivalent regulatory body.
- Experience working with high-performance athletes.
- Willing to participate in interviewing and audio recording.
- Proficient in English.

6.3.2 Participant Exclusion Criteria

- Non-medical professionals or those without direct involvement in SRC management.
- Professionals without HCPC certification or equivalent regulatory body certification.
- Those whose primary experience is outside of sport or SRCs.
- Professionals not currently practicing in high-performance sports settings.
- Those not proficient in English.

6.4 Data Collection

Data were collected through one-to-one semi-structured interviews, conducted online via Zoom. All interviews were led by the primary researcher and followed a standardised interview guide (see Appendix XI). Sessions ranged from 30-60 minutes and were audio-recorded with participant consent. Interviews were transcribed verbatim and anonymised during the transcription process. Notes were taken throughout to support follow-up questions and contextual interpretation. All recordings and transcripts were securely stored on an encrypted University of Essex Box Drive (University IT System) in compliance with institutional ethics.

6.4.1 Interviews

Each interview was designed to foster meaningful dialogue through broad, open-ended questions tailored to participants' experiences and professional context (43). The phrasing, sequence, and emphasis of each conversation shifted according to the participant's background and contributions (172). Not all pre-planned questions were asked. Instead, conversations were guided by participants' contributions and areas of expertise, fostering meaningful dialogue. This structure allowed for discussions to delve deeply into key themes while remaining flexible to participants' unique perspectives and experiences (169).

The interview guide was developed by the primary researcher in alignment with the study's research questions and analytic focus. Its content was also informed by relevant literature on SRC injury, perception of SRC, and multidisciplinary management strategies (28, 165, 173). Key areas of inquiry included diagnostic practice, guideline engagement,

barriers and facilitators, and suggestions for future improvement. A summary of the interview guide is presented in Table 7, and the full guide is available in Appendix XI.

Table 7

Shortened interview guide

Objective	**Questions**
Introduction	• Can you briefly introduce yourself and describe your experience with sport-related concussions? • In one word, how would you describe the current state of concussion management in sports?
Understanding and Awareness of SRC	• What is your understanding of sport-related concussions (SRC) – i.e., if someone were to ask for a definition, how would you yourself choose to define it? • Of the existing SRC guidelines, which ones are you aware of, and which do you most commonly apply in your practice? • How do you typically receive new information about SRCs? • How do you feel about the current methods used for diagnosing, treating, and managing SRCs? • What emotions do you experience when dealing with a case of SRC? • How do you perceive the role of education and knowledge dissemination in improving the management of SRC?
Barriers, Facilitators, and Reflections in SRC Management	• What are some of the most challenging barriers you face when diagnosing and managing SRCs? • What is your preferred method for accessing new information about SRCs? • Can you discuss a memorable time that you have interacted with SRC? • Can you describe any experiences where you have faced dilemmas in managing SRC?
Future Strategies and Improvements	• In your opinion, what is the best current approach to managing SRCs? How could this approach be improved? • Is there any information regarding SRCs that you believe is outdated? • Can you suggest any new approaches or strategies that could improve the management of SRCs? • What aspects of the current environment surrounding SRC do you enjoy? • If you were to personally design or create an ideal SRC program, from diagnosis to treatment to management, what key components would be included?

6.4.2 Ethics

This project has been granted ethical approval by the Ethics Sub Committee 2 at The University of Essex as of 20/08/2024. The ethics reference number is ETH2324-2077.

6.4.3 Informed Consent

Informed consent was obtained from all participants before the commencement of data collection. Participants were provided with a digital Participant Information Sheet outlining the study's purpose, methodology, and their rights (see Appendix X). Written consent was gathered electronically to ensure clarity, convenience, and ethical compliance.

6.4.4 Confidentiality and Data Management

Confidentiality was upheld throughout the project following institutional ethics. Identifiable information was used only for communication and consent processes, then securely discarded. Interviews were anonymised during transcription, and pseudonyms were applied to protect participant identity. Access to identifiable data was restricted exclusively to the research team. Once transcription was completed, all audio recordings were permanently deleted, ensuring they were inaccessible to all parties. Anonymized data will remain securely stored on the University of Essex Box Drive, adhering to ethical research standards. Data no longer required was permanently deleted.

6.5 Analysis Methods

6.5.1 Interview Transcription

Interview transcription served as a crucial bridge between data collection and analysis, allowing the research team to engage deeply with participant responses (45, 174). All interviews were manually transcribed verbatim by the primary researcher shortly after data collection. A balanced approach was adopted, combining aspects of naturalised and denaturalised transcription (174, 175). While minor fillers (e.g., “um,” “uh”) were removed to improve clarity, meaningful pauses, hesitations, and speech patterns were retained to ensure accuracy and authenticity in participants’ narratives.

6.5.2 Thematic Analysis

Reflexive THEM-A was employed as the method of data analysis for this study, following the structured six-phase approach established by Braun and Clarke (44). This approach provides a clear, step-by-step process for organizing and interpreting qualitative data. THEM-A is particularly suited for identifying and analysing patterns within qualitative datasets, offering the flexibility to adapt to the complexity of the data while maintaining a rigorous analytical structure.

6.5.2.1 Familiarising Yourself with the Data

Following data collection, the research team immersed themselves in the transcripts by reading and re-reading each interview to gain a deep understanding of participants’ perspectives.

6.5.2.2 Generating Initial Codes

Key features of the data were systematically coded across the dataset. Codes captured both anticipated areas of interest and emerging insights, serving as the foundation for theme development. These codes allow the researchers to organize and distil the data into manageable units while remaining open to emergent patterns that were not anticipated during the design phase. At this stage, both overarching themes and sub-themes began to emerge, reflecting the nuances in the participants' experiences and perspectives.

6.5.2.3 Generating Initial Themes

Following the coding phase, the researcher engages in an iterative process of reviewing, constructing, and refining the initial themes. This step required a critical examination of the coherence and distinctiveness of each theme to ensure they accurately captured the essence of the data. Themes were re-examined in relation to the dataset to evaluate their relevance, and ensure interpretive coherence, while new categories or patterns were explored as necessary.

6.5.2.4 Developing and Reviewing Themes

Themes were refined in relation to the coded data and the full dataset to ensure coherence and distinctiveness. Some themes were merged, discarded, or reorganised during this iterative process. Defined themes provided a structured lens through which the data could be understood, offering insights into key concepts and relationships between themes.

6.5.2.5 Refining, Defining, and Naming Themes

Each theme was clearly defined, and subthemes were also articulated to represent variations in experience or emphasis within major themes

6.5.2.6 Writing

Themes were synthesised into an analytic narrative that explained relationships within the dataset and connected findings to the research objectives and existing literature. This methodological approach allowed for a comprehensive understanding of the professionals' attitudes, challenges, and strategies, ultimately contributing to the broader discourse on SRC management practices in diverse sporting contexts (44, 176).

6.5.3 Analytic Process

Across a total of six transcripts, initial coding was conducted in NVivo through line-by-line engagement with the data. Theme development followed the guidance of Braun & Clarke (20, 45, 177). This process resulted in a structured node framework comprising four major themes, ten primary subthemes, and two nested themes, each populated through iterative coding and refinement. Codes were collapsed, relabelled, and re-organised as patterns became clear across participants and contexts. Coded segments were generated across all transcripts and were reviewed to ensure coherence within and across nodes. A key analytical challenge was managing conceptual overlap between ‘uncertainty’, ‘confidence’, and ‘pressure’, which frequently co-occurred and required repeated checking against the full dataset to avoid duplicating themes. Theme development was primarily inductive, grounded

in the participants' accounts, while interpretation was informed by the study's interpretivist orientation and engagement with SRC literature.

Several candidate themes were developed during early analysis but were later merged into higher-order themes. For example, 'responsibility' initially emerged as a standalone concept, but was later embedded as a nested component within the theme relating to gaps in education, reflecting its contextual dependence. Analysis concluded once further re-reading and node refinement no longer produced meaningful changes to the thematic map and the final thematic structure was judged to provide a coherent and sufficient answer to the research question.

6.5.4 Research Reflexivity

This study adopts a reflexive THEM-A approach, as outlined by Braun and Clarke, which positions the researcher as an active participant in the process of knowledge production (20). Within this framework, coding is not treated as a neutral or objective procedure, but rather as a meaning-making activity shaped by the researcher's positionality. Reflexive THEM-A acknowledges that interpretation is both inevitable and valuable, particularly when investigating complex social phenomena such as SRC. The analytic process was informed by an awareness of how assumptions, disciplinary training, and contextual knowledge influence the development of themes. As Braun and Clarke assert, "*our assumptions always influence our research- it's not a question of whether they influence, but how they influence*" (p.18)(20). The researcher conducting this study held an academic background in kinesiology with a minor in sociology and brought personal experience in athletics. Having sustained a concussion and witnessed its effects among peers, the researcher developed a strong interest in SRC as a unique and multifaceted injury, distinct from other

physical injuries due to its invisible symptoms and uncertainty. These lived experiences and disciplinary foundations shaped the researcher's sensitivity to the topic and informed their approach to data collection and interpretation.

Reflexive practices were embedded throughout the project to account for this positionality. A research journal was maintained during all stages of the study to document analytic decisions, personal reactions, and emerging questions. Reflexive journaling prompted the researcher to reconsider initial assumptions and deliberately re-engaged with the full dataset to ensure all views were considered with equal attention. This journal served not only as a record of methodological development but as a space for self-awareness (177). Additional strategies for supporting reflexivity included memo-writing during coding, theme refinement with supervisor feedback, and deliberate revisiting of assumptions throughout the analytic journey. Excerpts from this reflexive journaling are available in Appendix XII. These efforts supported an interpretive account of participants' perspectives, while remaining attentive to the influence of the researcher's own stance and evolving understanding.

6.5.5 Analytical Rigour and Intersubjectivity

Analytical rigour was conceptualised in accordance with contemporary critiques of verification-oriented approaches to qualitative quality within sport and exercise science (178). Grounded in interpretivist principles, knowledge in this study was understood as constructed rather than discovered (179). Accordingly, inter-researcher reliability was not adopted as a mechanism for verifying accuracy, as this is inconsistent with interpretivist assumptions (178). Instead, rigour was developed through iterative engagement with the

dataset, reflexive memo-writing, and sustained supervisory dialogue throughout the analytic process. Emerging codes and themes were regularly discussed with supervisors who acted as critical readers. These discussions were not intended to achieve or confirm correctness, but to challenge assumptions, interrogate analytic decisions, and explore alternative interpretations. This process strengthened the coherence and defensibility of the thematic structure while acknowledging that multiple plausible interpretations of the data could exist (178). Intersubjectivity was recognised as central to both data generation and analysis. Meaning was co-constructed within interviews through dialogue between researcher and participant, shaped by shared disciplinary language and the researcher's semi-insider positioning. The resulting interpretations are therefore presented as reflexively developed and theoretically informed constructions grounded in participant narratives, rather than objective representations of an external reality.

Section 7 - Results and Findings

7.1 Participant Details

Six medical professionals participated in the study, comprising four physiotherapists and two sports therapists. All were accredited by the Health and Care Professions Council (HCPC) or an equivalent regulatory body and had current or prior experience managing SRCs in high-performance sport contexts. Participant qualifications and sporting experience are listed in Table 8. Participants met the inclusion criteria and represented a range of ages, years of experience, and sporting environments. Aiming for data saturation, this sample yielded a diverse range of experiences across different sports and professional backgrounds. Data saturation refers to the point in qualitative research when no new information, themes,

or insights emerge from additional data collection, and further coding becomes redundant (180). Aligning with interpretivist philosophy, data collection concluded when further interviews did not meaningfully extend the interpretive depth of the developing analysis (19, 166, 179).

It is important to acknowledge the gendered context of the participant group and their sporting environments. All participants were male, and most described working within male athlete populations and mixed-gender clinic settings. No participant identified working exclusively within women's high-performance sport. As such, the discussions surrounding SRC management were situated within predominantly male sporting cultures. This contextual positioning may have shaped how confidence, authority, communication, and pressure were articulated throughout the interviews, and should be considered when interpreting the findings.

Table 8

Demographic characteristics of study participants

Participant	Age	Role	Years of Experience	Sport	Qualifications
Scott	23	Sports Therapist	1	• Rugby • Football	• BSc Sports Therapy
Leon	23	Sports Therapist	2.5	• Rugby • Football	• BSc Sports Therapy • Society of Sports Therapists
Brett	58	Physiotherapist	36	• Cricket • Basketball	• Chartered Physiotherapist recognised by HCPC
Gregory	35	Physiotherapist	15	• Cricket	• BSc Physiotherapy • MSc Sports Exercise Medicine • Sports Physiotherapist
Jamie	55	Physiotherapist	27	• Cricket	• BSc Physiotherapy • MSc Advanced Physiotherapy • HCPC and CSP Member
Adrian	31	Physiotherapist; Athlete	7	• MMA	• BSc Physiotherapy • HCPC Member

7.2 Overview of Themes

The analysis process generated four major themes, each supported by relevant subthemes, with three themes embedded within subthemes where appropriate, as captured by Figure 13. The coding was iterative and interpretive, with themes refined and reorganized throughout the process to reflect nuanced patterns in participant experience. The final thematic structure captures the complex and evolving landscape of SRC management from the perspective of HCP.

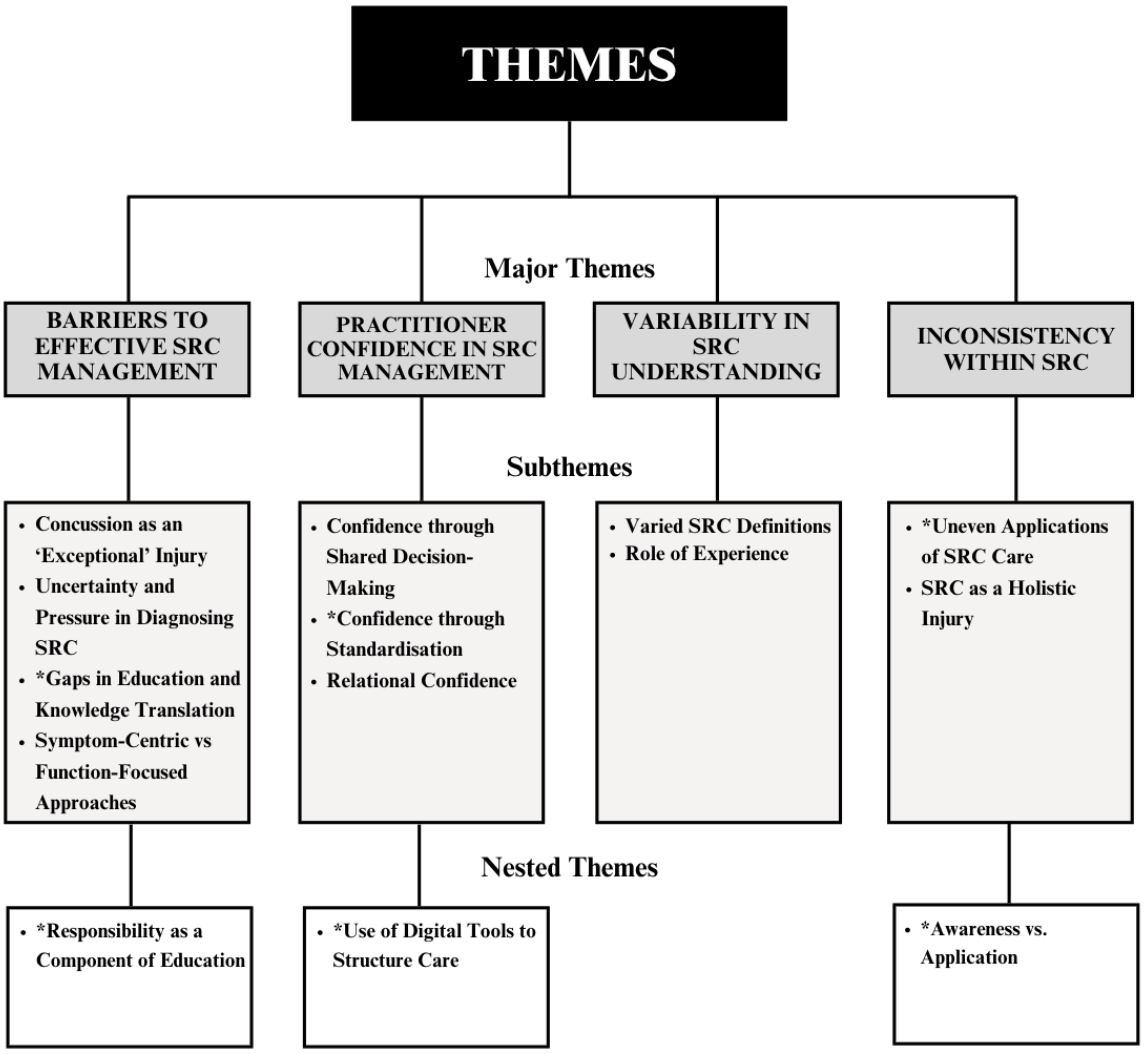

Figure 13: Flowchart overview of major themes, subthemes, and nested themes

7.3 Analysis and Evidence of Themes

7.3.1 Major Theme: Barriers to Effective SRC Management

A range of barriers emerged across all participants that hindered the effective identification and management of SRC, forming a prominent overarching theme. These barriers spanned both individual-level challenges and broader structural issues. To reflect the nuanced ways these obstacles appear in practice, this theme includes four interrelated subthemes: *Concussion as an 'Exceptional' Injury*, *Uncertainty and Pressure in Diagnosing*

SRC, *Gaps in Education and Knowledge Translation*, and *Symptom-Centric Vs Function-Focused Approaches*. One additional nested subtheme, *Responsibility as a Component of Education*, is embedded within the third subtheme. These thematic strands interact with one another, suggesting that barriers to effective care cannot be understood in isolation from the structural and cultural contexts in which practitioners operate. Drawing on practitioners lived experiences, the following sections explore how these barriers manifest in clinical and sport-specific environments. Participant narratives highlight how institutional pressures, cultural expectations, and diagnostic uncertainty intersect to shape real-world SRC management. To see participant information, see Table 8.

7.3.1.1 Subtheme: Concussion as an 'Exceptional' Injury

Participants consistently described SRC as fundamentally different from other injuries, particularly when compared to musculoskeletal conditions. Unlike physical injuries with visible symptoms and standard diagnostic tools, concussion was portrayed as an invisible and inherently subjective condition, one that presented unique challenges in both identification and validation. This distinction led to frustrations among clinicians, as SRC's unpredictability made it difficult to assess and communicate with certainty. Jamie, an extremely experienced physiotherapist, reflected on this difficulty by noting:

"Concussion is quite serious... players will accept the diagnosis about musculoskeletal injuries without really a second thought… they're more accepting of that. It's something more tangible, isn't it? To them." (Jamie, Cricket, 27 years of experience)

Similarly, Adrian, a physiotherapist, reinforced this point, describing bodily injury as:

"*More tangible compared to what's between the ears"* (Adrian, MMA, 7 years of experience)

These reflections underscore the diagnostic ambiguity of SRC and the difficulty of legitimising it within athlete and coaching cultures accustomed to physical injury norms. Notably, Jamie also observed a shift in sports' response to SRC:

"We are much more aware of … recognising it and not ignoring it... not brushing over it as much as we did 10 years ago." (Jamie, Cricket, 27 years of experience)

This theme was echoed across all participants. Leon, a novice sports therapist, went on to compare bodily injury to SRC:

"I think that it's just people thinking, 'oh I'm fine, I'm going to go and play, ' which, if you got a hamstring injury or anything like that, you… might feel a little tight or something like that, right, so, it's slightly different, and I definitely think there's a lack of visible symptoms, should we say, in the whole process…I think doesn't necessarily help." (Leon, Rugby & Football, 2.5 years of experience)

This distinction, and the frustration that surrounds it, was expressed across all levels of experience. The collective emphasis on SRC's exceptional status reveals how deeply entrenched assumptions about injury visibility continue to influence clinical and sporting responses to concussion.

7.3.1.2 Subtheme: Uncertainty and Pressure in Diagnosing SRC

Participants described the ambiguity surrounding SRC as a distinct challenge. Without a definitive diagnostic test, and with symptoms that can be variable, SRC management was recognised as a nuanced process. This uncertainty was amplified by the challenge of working within sporting environments where external pressures, such as the desire to win, return players quickly, or interpersonal dynamics, could reinforce the uncertainty practitioners already navigate. Uncertainty was frequently tied to the absence of definitive diagnostic tools. Adrian, reflecting on his experience managing SRC in combat sport, noted the discomfort and caution involved in these decisions:

"It's not necessarily something nice to be speaking about... particularly when you haven't got conclusive evidence..." (Adrian, MMA, 7 years of experience)

Without a reliable objective measure, clinicians described relying on symptoms and subjective indicators to make high-stakes decisions. This ambiguity created pressure, particularly when clinical judgments had direct implications for team performance or athlete availability. Jamie, who worked in both individual and team sport settings, described this tension:

"Quite a lot of pressure sometimes to make these decisions." (Jamie, Cricket, 27 years of experience)

He elaborated that this pressure intensified when diagnoses triggered mandatory exclusion rules, potentially affecting match outcomes or athlete progression. Gregory, a

sports medicine physiotherapist with extensive field-side experience, added further insight into the seriousness of the role:

"We are talking about people's lives, their brains… It's pretty daunting." (Gregory, Cricket, 15 years of experience)

These reflections collectively highlight the weight of responsibility practitioners bear when working with SRC in high-performance environments. The intersection of medical ambiguity and sporting urgency consistently challenged practitioners' confidence and decision-making, underscoring the complexity of SRC diagnosis in real-world practice.

7.3.1.3 Subtheme: Gaps in Education and Knowledge Translation

Practitioners described SRC education as inconsistent and insufficient, both in their professional development and in the wider community. Brett, an extremely experienced practitioner, stated directly:

"I would educate practitioners more." (Brett, Cricket & Basketball, 36 years of experience)

When asked about SRC evaluations, Gregory pointed to a gap in knowledge translation:

"People haven't quite translated that into practice… they're not being lazy, they are just not aware that they need to." (Gregory, Cricket, 15 years of experience)

Leon and Scott, novice clinic-focused sport therapists, relied heavily on guidelines without always questioning their limitations. By contrast, Gregory, with 15 years of experience, noted how his growing career helped him challenge protocol rigidity and focus on more individualised care. Jamie reflected on this shift over time, admitting that earlier in his career:

"Unless you were spinal code down on the floor… you would just carry on… physio's… tried not to diagnose concussion." (Jamie, Cricket, 27 years of experience)

When asked about inter-practitioner conflict in managing SRC, Jamie observed a reversal in attitude:

"Some of the more junior physios were frightened to almost diagnose a non-concussion." (Jamie, Cricket, 27 years of experience)

This highlighted the ongoing uncertainty and fear of misdiagnosis. Adrian, despite his dual role as an active athlete and practicing physiotherapist, acknowledged:

"I have not [done training]" specific to concussion, but he tries to *"speak to the [athletes]… to see where they're at in terms of their symptoms".* (Adrian, MMA, 7 years of experience)

He recognised the need for clearer guidance, reflecting:

"There seems to be a lack of protocol and structure in place across the board. [Concussion]… is a term that's thrown around a lot without the understanding... understanding the significance of it… the significant effect it can have, and also the severity of it." (Adrian, MMA, 7 years of experience)

This range of insights reflects broader challenges in translating SRC knowledge into practice. Gregory, who works across both field and clinical settings, observed:

"Most evidence is actually behind practice… when you get evidence, it validates… what you already thought and are doing." (Gregory, Cricket, 15 years of experience)

This suggests that clinical improvement occur through experiential learning first and is later supported by formal knowledge translation. Such delays between learning and implementation formed what could be described as a recurring feedback loop, particularly for early-career practitioners or those working in less regulated sporting environments. Jamie, a physiotherapist with 27 years of experience, noted that within his team:

"The whole idea of… rehabbing a concussion is a relatively new thing for us here." (Jamie, Cricket, 27 years of experience)

This comment underscored the novelty of function-focused SRC care. Athletes' and coaches' misconceptions further complicated care, particularly when symptom-free status was misunderstood as full recovery. Leon reflected on how his athletes often misinterpreted recovery:

"I think people kind of think… they're 'symptom free', that the concussion is… gone… as such… They go "ah, well you know, don't have a headache anymore so I'm going to go back and play" which obviously we know isn't the case in that sense…so I do feel like … people are… uneducated on that sense." (Leon, Rugby & Football, 2.5 years of experience)

When asked why such resistance persists, Jamie commented on cultural expectations in professional sport:

"It's all the cliches about professional sport, really. They don't want to lose their place in the team, they don't want to be seen as weak… they want to play and… they want to win." (Jamie, Cricket, 27 years of experience)

This absence of consistent training not only shaped how practitioners diagnosed SRC, but also how confidently they communicated risk, reinforced care strategies, and engaged others. These patterns illustrate how gaps in education and knowledge translation may reinforce uncertainty, hesitation, and suboptimal care across practice settings.

7.3.1.3.1 Nested Theme: Responsibility as a Component of Education

Individual and institutional responsibility emerged as a meaningful thread within participants' views on education. While many recognised the need for improved education, few described systematic efforts to pursue it independently. Adrian reflected on his plans to update SRC care amongst his athletes:

"What I intend to do... is get some baseline measures... I was thinking of implementing it pre- and post [events]". (Adrian, MMA, 7 years of experience)

His comment highlights the perceived burden of responsibility among clinicians, particularly in less formal or unregulated settings, such as combat sports. In contrast, Jamie highlighted the positive impact of receiving structured education:

"I've been on the receiving end of that education, and it's changed the way I think about things and practice, and everything else". (Jamie, Cricket, 27 years of experience)

This comparison illustrates how access to meaningful, context-specific education can increase confidence, shift thinking, and enhance practice consistency. Brett also stressed the ethical dimension of clinical responsibility, stating:

"Someone has got to actually take a bit of responsibility for… both their actions as a clinician… responsibility for patients we look after… for the organisations we represent". (Brett, Cricket & Basketball, 36 years of experience)

Similarly, Jamie (Cricket, 27 years of experience) underscored the importance of leadership in promoting meaningful change, commenting that someone needs to "take the lead" so that we can "make those changes" within SRC care. Collectively, these reflections position responsibility, both individual and collective, as a critical yet often overlooked component of effective SRC education.

7.3.1.4 Subtheme: Symptom-Centric vs Function-Focused Approaches

Several experienced practitioners critiqued the reliance on symptom checklists to determine readiness for RTP. Jamie, a practitioner with 27 years of experience, noted:

"We don't do any kind of targeted recovery... that's outdated, and we are looking to change [it]." (Jamie, Cricket, 27 years of experience)

This comment reflected broader dissatisfaction with symptom-based protocols, which were seen as oversimplified. Similarly, Gregory, who works across high-level sport and clinic settings, questioned the assumption that symptom resolution equals readiness:

"Technically, you could be asymptomatic in two days, but your oculomotor function might be off... and you won't be able to perform." (Gregory, Cricket, 15 years of experience)

These reflections suggest that current models often neglect functional impairment that persists beyond symptom resolution. For Adrian, this approach reflected an embedded way of thinking, highlighting symptom-dependent recovery:

"It's all time-dependent and symptom-dependent, really." (Adrian, MMA, 7 years of experience)

The prioritisation of symptoms as the key recovery metric may inadvertently enable negligence of well-being and functional recovery. Across participants, there was shared recognition that a shift toward function-focused, domain-specific care is both necessary and underway, though unevenly across sports and settings.

7.3.2 Major Theme: Practitioner Confidence in SRC Management

Confidence in SRC management was a key theme across participant narratives. While all six practitioners reported moments of uncertainty in clinical decision-making, the data suggested that confidence often emerged from a combination of experiential learning, access to support systems, and the strength of practitioner–athlete relationships. This theme was broken down into three subthemes: *confidence through shared decision-making, confidence through standardisation*, and *relational confidence*. A nested subtheme also emerged, highlighting the *Use of Digital Tools to Structure SRC Care*.

Importantly, practitioner confidence did not appear as a static trait, but as something developed and refined over time. Across his decades of experience, Jamie mentioned broad shifts in awareness, stating:

"We're much more aware of recognising [SRC] now and not ignoring it as much as we did 10 years ago." (Jamie, Cricket, 27 years of experience)

This change was also apparent at the individual level. Brett, for example, spoke of becoming more comfortable challenging protocols and applying functional assessments based on both experience and evolving knowledge over his 36 years of experience. He explained:

Earlier in my career… I was just ignorant. Going back 35 years, the advances in research in the last five years…it's phenomenal… I think now… I feel quite passionate about implementing a better pathway… and I also feel a touch of guilt for what I have did- for what I was doing 35 years ago, but I've got to get over that because actually what I know now wasn't known 35 years ago…" (Brett, Cricket & Basketball, 36 years of experience)

His reflection underscored the emotional weight of professional growth and the evolving nature of best practice. These examples suggest that clinical confidence may be influenced not only by formal education or structural supports, but also by broader cultural shifts in how SRC is discussed, taught, and understood. The relationship between growing awareness, reflective practice, and confidence will be explored further in the final discussion chapter.

7.3.2.1 Subtheme: Confidence Through Shared Decision-Making

Collaborative care emerged as one of the most consistent enablers of practitioner confidence. Participants noted that when SRC-related decisions were shared across clinical teams, or even when another practitioner was simply present, the emotional and cognitive burden of decision-making felt more manageable. Gregory, a senior clinician in elite sport, explained:

"I just want to do it with someone else… it's a lot less daunting… because there's so much to it." (Gregory, Cricket, 15 years of experience)

His comment reflected how working alongside others offered not only clinical reassurance but emotional grounding. For Gregory, shared responsibility reduced isolation and uncertainty, especially in high-stakes environments. He later reinforced the value of this approach, stating:

"Collaborative care is the way it should be." (Gregory, Cricket, 15 years of experience)

Such collaboration was not only seen as best practice but also as a means of reinforcing confidence, allowing clinicians to troubleshoot complex cases, cross-check evaluations, and feel supported in their decision-making. Brett echoed this view, highlighting how team-based environments encouraged learning:

"As part of the network, you can sort of bounce ideas off other people." (Brett, Cricket & Basketball, 36 years of experience)

Overall, participants framed shared decision-making not just as a mechanism for clinical quality assurance, but as a practice that enhanced clarity and supported more confident SRC management.

7.3.2.2 Subtheme: Confidence Through Standardisation

Standardisation also played a major role in building clinical confidence, especially for early-career practitioners. Structured RTP protocols, milestone-based assessments, and sport-specific guidelines helped participants navigate the ambiguity often associated with SRC.

Scott, reflecting on his experience as a new graduate, explained how protocol structure provided legitimacy to his decisions:

"This [decision] isn't me, this is what the guidance is." (Scott, Rugby & Football, 1 year of experience)

He further noted that standardised stages and criteria helped simplify decision-making:

"The guidelines have really helped… having the stages at the certain points with criteria to meet, it just makes our life a lot easier." (Scott, Rugby & Football, 1 year of experience)

For Scott, protocols offered more than just a sequence of tasks; they served as both a decision aid and a protective barrier, especially when managing external pressures from athletes, coaches, or sporting organisations. Similarly, Leon, a sports therapist with less than three years of experience, indicated that structured pathways were especially valuable when managing complex or borderline cases:

"I don't have sort of, my own kind of things that I look for as such, it's just following what else has been put out there." (Leon, Rugby & Football, 2.5 years of experience)

These protocols served not only as a scaffold for clinical reasoning but also as a defence against external pressures. Practitioners could defer to standardised protocols when athletes or coaches pushed for expedited clearance. Yet, despite this confidence-enhancing

effect, several participants hinted at the limitations of over-relying on standardisation. Brett cautioned against treating protocols as prescriptive tools, stating:

"Guidelines… are not dogmatic bits of paper and they don't replace clinical evaluation." (Brett, Cricket & Basketball, 36 years of experience)

His comment reflected a broader recognition that while standardisation supports practice, it cannot substitute for critical thinking. Gregory, drawing on years of experience in high-performance settings, echoed this sentiment, describing cases where his judgment required more nuanced or targeted interventions than protocols might formally allow. These reflections suggest that confidence is often built through a balance, using guidelines as a foundation, while also knowing when to adapt based on context, experience, and athlete-specific needs.

7.3.2.2.1 Nested Theme: Use of Digital Tools to Structure SRC Care

Participants also referenced the use of digital tools as part of their structured SRC care systems. These included online platforms for RTP tracking, digital SCAT forms, and institution-specific websites that provided timelines and guidance. For early-career practitioners, such tools functioned as accessible extensions of standardised protocols, offering reassurance while also supporting consistency. Scott described how one digital resource helped streamline care:

"[The website] … is nice and logical and easy for us to keep track of everyone." (Scott, Rugby & Football, 1 year of experience)

The digitalisation of SRC management protocols appeared to reinforce adherence and improve the clarity of communication between clinical staff. Leon also pointed to digital communication as a helpful means of reinforcing athlete adherence:

"[We] send them an email with a document for return-to-play guidelines, and … we ask them to follow up… if they need to." (Leon, Rugby & Football, 2.5 years of experience)

For less experienced practitioners, digital tools were often used as extensions of formal protocol, making them particularly helpful when confidence was still developing. Some participants also referred to more advanced technologies, including force plate testing, VR headsets, or reaction time software, which offered objective metrics to support return-to-play decisions. Gregory described digital tools as a means to objectify the subjective, explaining:

"I would almost go through… the domains of concussion and get a baseline objective score for everything… Could you get a baseline isometric c-spine strength? Could we get a baseline reaction mark? …Can we get a baseline- with a digital reaction, not like a ruler drop, like a digital psychometric vigilance test. Can we get baseline balance data on a force plate? … like getting valve force plate data… you've got all this technology like the VR headsets and stuff… Let's actually get objective data for that." (Gregory, Cricket, 15 years of experience)

For these participants, digital innovations not only supported clinical decisions but also offered a sense of objectivity and structure that reinforced practitioner confidence.

7.3.2.3 Subtheme: Relational Confidence

Confidence was not only shaped by tools and procedures but by the quality of the relationships between practitioners and their athletes. Participants described trust and familiarity as essential to navigating the emotional and behavioural complexities of SRC care. Jamie captured this dynamic directly:

"It's easier because I've got that relationship with them." (Jamie, Cricket, 27 years of experience)

For Jamie, relational familiarity created a foundation of trust that made it easier to recommend rest, enforce protocols, and initiate honest conversations, especially in cases where athletes downplayed symptoms or pushed for early return. This form of relational confidence supported not only clearer communication but also greater practitioner confidence when addressing sensitive or contested recovery decisions. Adrian, who had experience as both an athlete and a physiotherapist, spoke to the additional insight his dual role provided:

"Helps with trust, helps with a deeper understanding, and the related frustration of not being able to compete or train in a certain way." (Adrian, MMA, 7 years of experience)

This dual perspective provided a foundation for empathetic care and more effective communication, which in turn reinforced the clinician's confidence in managing difficult conversations.

7.3.3 Major Theme: Variability in SRC Understanding

While all participants recognised SRC as a legitimate and significant injury, their interpretations of what it is and how it is managed varied considerably. This theme captures the diversity of definitions and how understanding evolved, shaped by clinical experience, ongoing education, and exposure to different sporting environments. Some participants hesitated when asked to define SRC, while others leaned on consensus statements, symptom categories, or personal experience. This variability reflects not only the absence of a gold-standard definition but also the dynamic and evolving nature of SRC research and practice. Two subthemes emerged: *Varied SRC Definitions* and *The Role of Experience* in SRC understanding.

7.3.3.1 Subtheme: Varied SRC Definitions

Participants provided different, and sometimes inconsistent, descriptions of what constitutes a SRC. These ranged from symptom-based lists to more biomedical definitions referencing force and functional disruption. When participants were asked to describe the current state of SRC management, it was met with descriptions such as "evolving" (Jamie), "misunderstood" (Adrian), and "frustrating" (Leon). Furthermore, when asked about how it felt to interact with SRC, practitioners mentioned "always [getting] a bit nervous" (Scott), and experiencing "nervousness, anxiety, fear" (Gregory). Notably, several practitioners hesitated with their answers when asked to define SRC. Adrian described it as:

*"To have a concussion, it's just the number of symptoms that you can call a concussion... when you are symptom-free that's a really good way." (*Adrian, MMA, 7 years of experience)

This definition places emphasis on the presence or absence of symptoms, aligning closely with symptom-focused protocols described earlier. Similarly, Jamie admitted:

"I probably should be able to recite the official definition… I can't recite it back to you, actually…" (Jamie, Cricket, 27 years of experience)

This response points to lingering uncertainty even among experienced clinicians regarding standardised definitions. Some participants attempted to recall external definitions, with mixed clarity. Gregory, referencing the CISG statement, said:

"Something about… force to the body by biomechanical forces calling it a head injury." (Gregory, Cricket, 15 years of experience)

He went on to explain that SRC should be viewed as:

"An umbrella term for brain injury… that can affect a number of different functions of the brain." (Gregory, Cricket, 15 years of experience)

These moments of vagueness are significant. They reflect a clinical landscape in which SRC is widely recognised but not uniformly understood. Even when practitioners are confident in managing SRC, the lack of definitional consensus may hinder consistency in

communication with athletes, coaches, and other stakeholders. Across the dataset, this variability in definition contributed to broader inconsistencies in SRC care and was often a source of personal uncertainty.

7.3.3.2 Subtheme: Role of Experience

Participants' understanding of SRC often shifted with clinical exposure. More experienced practitioners tended to describe SRC in functional, dynamic terms, relying less on textbook definitions and more on patterns observed across repeated cases. Leon, a practitioner with less than three years of experience, reflected that:

"After study, you develop your own ways of explaining that." (Leon, Rugby & Football, 2.5 years of experience)

This highlights how post-qualification experience helped reshape his understanding beyond formal education. This process of learning and re-learning SRC management was also described by Gregory, who noted:

"Most evidence is actually behind practice… when you get evidence, it validates probably already what you thought." (Gregory, Cricket, 15 years of experience)

These quotes reflect a broader pattern across the interviews. Many practitioners do not wait for scientific consensus to shift their practice. Instead, they adapt based on repeated clinical encounters, often ahead of published recommendations. This may account for some

of the definitional variation observed. Practitioners are synthesising experience, evolving research, and individual patient contexts to form a working understanding of SRC that may not always align with formal guidelines. In contrast, earlier-career practitioners such as Scott and Leon often relied on established protocols or tools to define and guide care. This reliance was not necessarily due to a lack of knowledge but reflected a preference for structured guidance. As Adrian explained:

"You're always going to get pushback from the fighters… they think they're fine… they just don't remember it." (Adrian, MMA, 7 years of experience)

Leon shared how guidelines helped manage such interactions:

"I… often agree on the kind of… guidelines and actions we need to take… There should be no disagreement." (Leon, Rugby & Football, 2.5 years of experience)

This illustrates how structured approaches can provide useful scaffolding for practitioners still building clinical confidence. Without a deeper clinical base to interpret ambiguous or subtle signs, these practitioners leaned on institutional definitions and conservative management to protect athlete safety. Over time, however, the interviews suggested that confidence in understanding SRC becomes more nuanced, shaped by patterns in how the injury presents and how athletes respond. Together, these subthemes reflect the tension between formal education and experiential learning in shaping how SRC is understood in practice. Definitions are not static but negotiated through interaction with athletes, evolving consensus statements, and professional development.

7.3.4 Major Theme: Inconsistency within SRC

Across all interviews, participants highlighted inconsistencies in how SRCs are approached, interpreted, and enforced across SRC management. While most practitioners agreed on the importance of early recognition, appropriate RTP timelines, and athlete-centred care, the actual delivery of this care varied across contexts, sports, and individual clinicians. This theme captures two interrelated subthemes: *Uneven Applications of SRC Care* and *SRC as a Holistic Injury*, with a nested subtheme exploring the gap between knowledge and implementation: *Awareness vs Application*.

7.3.4.1 Subtheme: Uneven Applications of SRC Care

Participants described SRC care as highly dependent on context, particularly the sport, competition level, and institutional culture in which care was delivered. Brett drew attention to this variability, observing:

"It's almost as if we decided that someone's brain, if you're playing grassroots football, is different to someone's brain if you're a professional footballer… and they got totally different physiological timeframes for recovery…" (Brett, Cricket & Basketball, 36 years of experience)

This assumption, he implied, was less about the athlete's actual physiology and more about external pressures and access to care. In high-performance settings, faster RTP may be justified by greater medical oversight, but it also reflects an uneven playing field. The same injury could result in vastly different care depending on context. This inconsistency also appeared in how SRC labels were applied. Jamie noted that coaches and athletes were sometimes reluctant to accept a concussion diagnosis due to its consequences, stating:

"We've had players that also know the system very well, and they know they really do not want to be diagnosed with concussion." (Jamie, Cricket, 27 years of experience)

Furthermore, he discussed how athletes become aware of SRC safeguards, explaining:

"They will be masking symptoms, and they will be telling you that they're fine and they will be very keen… not to be called our or to be labelled." (Jamie, Cricket, 27 years of experience)

Practitioners thus found themselves mediating between clinical judgment and an athlete's fear of being pulled from play. The decision to formally diagnose SRC had clear administrative and performance-based consequences, which further contributed to uneven enforcement. In less formal or unregulated sports, Adrian explained that structural limitations left practitioners without the same diagnostic protocols or safety nets:

"There seems to be a lack of protocol and structure in place, across the board." (Adrian, MMA, 7 years of experience)

Moreover, Adrian discussed differences between sports, explaining that within combat sport, there is:

"Less infrastructure within the sport… there is nothing stopping them from [participating] the next weekend." (Adrian, MMA, 7 years of experience)

This structural gap forced individual practitioners to create their own systems, often informed by trust, rapport, and personal experience. As a result, SRC care became inconsistent not only across sports, but within the same sport across levels, or even between athletes on the same team.

7.3.4.1.1 Nested Theme: Awareness vs Application

Several participants also reflected on the gap between what practitioners know and what is implemented in practice. This subtheme captures a common concern that awareness of SRC best practice does not always translate into action. Gregory articulated this disconnect directly:

"*The majority of people aren't even looking for… not even assessing c-spine… vestibular ocular…*", further adding that *"the consequences [are] so significant."* (Gregory, Cricket, 15 years of experience)

This statement highlights both a lack of engagement with existing guidance and a broader failure in knowledge mobilisation. Even when protocols are available, they are not always followed or enforced. Brett echoed this, noting that education is outdated and that practitioners may fail to adapt to updates in SRC care. When asked his perspective on current SRC management, he replied:

"I think the ongoing assessment in a multi-modal way… is probably 2/10." (Brett, Cricket & Basketball, 36 years of experience)

When asked to clarify his rationale, he expressed:

"In terms of piecing it all together… I think we're not great, if I'm honest with you." (Brett, Cricket & Basketball, 36 years of experience)

This gap between awareness and implementation was most evident when participants reflected on what should happen versus what happens in real-world care. It was not uncommon for practitioners to describe best-practice approaches while simultaneously admitting that improvements were necessary. This contradiction contributes to a wider culture of uneven SRC application, where ideal care pathways were known but inconsistently practiced.

7.3.4.2 Subtheme: SRC as a Holistic Injury

Another layer to SRC inconsistency emerged from how the injury itself was understood and addressed. While many participants began by describing SRC as a "head injury" (Leon, Gregory, Jamie, Scott), several went on to recognise that SRC could not be separated from the athlete's broader physical, cognitive, and emotional wellbeing. Brett reflected on active SRC management, stating:

"I think that word 'rehabilitation' is important… we shouldn't underestimate the psychological improvement and doing something!" (Brett, Cricket & Basketball, 36 years of experience)

This view positioned SRC not as an isolated diagnosis, but as a condition requiring holistic management. Participants referenced migraine symptoms, oculomotor deficits, autonomic dysfunction, and psychological strain, all as elements that might persist despite an athlete being symptom-free. Gregory offered a detailed example:

"Technically, you could be asymptomatic in two days, but your oculomotor function might be off... and you won't be able to perform." (Gregory, Cricket, 15 years of experience)

This functional lens introduced further inconsistency. Jamie admitted that in previous years, his team and he were passive in their approach, explaining:

"We were still pretty much monitoring them until their symptoms disappeared." (Jamie, Cricket, 27 years of experience)

Practitioners who viewed SRC holistically were less likely to rely solely on symptom resolution and more likely to delay RTP or introduce additional assessment steps. In contrast, those working within more rigid, symptom-based frameworks were often limited in their ability to explore broader functional or mental health impacts. Moreover, the athlete's perceived capacity and sport type shaped care. For example, Adrian spoke from dual perspectives, both as an athlete and a clinician, and recognised how competitive culture shaped his understanding:

"There's going to be some level of impact. What that means late down the line we don't necessarily know... but it's important to be training smart." (Adrian, MMA, 7 years of experience)

He also urged that individualised treatment was crucial to address the needs of the whole athlete. To do this, he explained:

"You need a level of transparency from the [athletes] themselves… [it] will determine how truthful they are willing to be." (Adrian, MMA, 7 years of experience)

This remark suggests that even with insight, practitioners may struggle to implement holistic care in sports where risk is embedded in the culture. Taken together, these findings suggest that inconsistencies in SRC care are not just due to protocol gaps but are also tied to whether SRC is viewed as a checklist to be cleared or as a complex, ongoing process of rehabilitation.

Section 8 - Discussion

8.1 Summary of Findings

This study explored how MPs working in high-performance sport approach the diagnosis, management, and understanding of SRC. The reflexive THEM-A generated four major themes, each containing interrelated subthemes and nested concepts that offer insight into the practical, emotional, and structural realities of SRC care. The first theme, *Barriers to Effective SRC Management*, revealed a range of individual and institutional challenges that

hinder effective care, including diagnostic uncertainty, educational gaps, and an overreliance on symptom-based checklists. The second theme, *Practitioner Confidence in SRC Management*, addressed how confidence develops over time, influenced by education, clinical exposure, and relationships with athletes. The third theme, *Variability in SRC Understanding*, captured inconsistencies in how SRC was defined and conceptualised. While some participants offered vague or symptom-driven definitions, others articulated a more functional understanding. Finally, *Inconsistency within SRC* examined how care differed across contexts, sports, and performance levels. Subthemes and nested concepts within each theme demonstrated that even among experienced professionals, SRC remains a complex, multilayered challenge that is inconsistently operationalised in practice.

8.2 Interpreting the Findings in Relation to the Literature

8.2.1 Holistic Nature of SRC and Need for Biopsychosocial Approaches

The findings from this study reveal limitations in symptom-focused approaches to SRC and emphasise the value of more holistic, context-sensitive frameworks. Across interviews, participants described SRC as a complex, multifaceted injury that extended beyond immediate physical symptoms to include cognitive, emotional, and social dimensions. These perspectives align closely with the biopsychosocial model, which recognises the dynamic interaction of biological, psychological, and social factors in health and illness (26, 181). This framework is especially relevant to SRC, an injury that is often invisible, variable in presentation, and influenced by environmental context. This model has become increasingly prominent in SRC research and rehabilitation, offering a more comprehensive approach to understanding and managing recovery (182, 183).

More experienced practitioners appeared to move beyond protocol-driven care, instead describing SRC in functional terms that reflected broader physical, cognitive, and emotional domains. These insights align with literature calling for SRC to be viewed as a multidimensional condition, with symptom resolution representing only one facet of recovery (184). Experienced practitioners emphasised the importance of identifying domain-specific deficits, such as oculomotor function, autonomic response, or vestibular symptoms, that may persist even when athletes appear outwardly well. Such remarks suggest that many of the experienced clinicians in this study had adopted a functional mindset, one that aligns with recent shifts in SRC literature advocating for tailored management to individual profiles (185).

The biopsychosocial model offers a useful foundation for interpreting these perspectives. By framing SRC as an injury that intersects with cognition, emotion, and behaviour, it supports athlete-centred care that responds to individual experiences and needs. This is especially important in high-performance sport, where athletes face unique sociocultural pressures that influence symptom reporting, treatment adherence, and RTP decisions (186). Despite this, less experienced practitioners were more likely to rely on symptom checklists and guideline-driven care, while more experienced clinicians described confidence in deviating from structured protocols when patient context demanded it. This difference may reflect an evolution in clinical reasoning that develops through experience and reflective practice. Such variability highlights an important gap between awareness of multidimensional care and the ability to implement it consistently.

Taken together, these findings suggest that the biopsychosocial model is not just relevant but essential to addressing the complexities of SRC. By moving beyond symptom

resolution, this model supports more consistent, athlete-centred care across diverse sport settings. Embedding it into future education and clinical guidelines may help bridge persistent gaps between clinical recovery and functional return. Biopsychosocial approaches to rehabilitation advocate for multifaceted recovery and treatment strategies, and participants in this study consistently framed SRC not as an isolated physical event, but as a condition with wide-ranging effects on mental health, identity, and performance (183).

8.2.2 The Evolution of Practitioner Confidence

A key finding of this study was the variation in practitioner confidence regarding SRC management. While participants broadly recognised SRC as a serious injury, their comfort in making decisions, particularly around diagnosis and RTP, varied according to experience. More experienced practitioners described confidence as something developed over time, shaped by repeated exposure to SRC cases and informal learning through peer interaction. This aligns with existing literature on clinical reasoning, which suggests that health professionals move from rule-based approaches to more intuitive decision-making as they gain experience (187). It also reflects Schön's concept of the "reflective practitioner," in which professionals actively interpret and reshape their practice through self-assessment and learning from experience (188). Less experienced clinicians, in contrast, often relied on structured protocols and standardised tools to guide their decisions. Rather than interpreting symptoms independently, these practitioners found reassurance in clearly defined procedures. However, confidence was not solely tied to experience. Many participants described collaborative decision-making as central to their confidence development, with team-based environments enabling distributed responsibility and peer validation.

Confidence was also relational in nature. Practitioners who had long-standing connections with athletes reported feeling more comfortable initiating difficult conversations or pushing back against resistance. In such cases, trust was not incidental but foundational to confident care. This aligns with research suggesting that in high-performance sport, clinical decisions often unfold within networks of interdependence, where uncertainty is mediated through familiarity and mutual understanding (164). Rather than relying solely on formal guidelines, practitioners built trust and confidence through shared sporting cultures and negotiated relationships. These findings reinforce that practitioner confidence is not a static trait, but a dynamic process shaped by learning, relationships, organisational culture, and real-world experience. Although confidence itself is not a formal component of most SRC protocols, it may be a hidden driver of care quality.

8.2.3 Knowledge to Practice: Role of Education

Participants across the study consistently identified education as a central factor influencing the quality and consistency of SRC care. While many acknowledged improvements in SRC awareness over the past decade, several described persistent gaps in formal training. These gaps were especially evident during early career stages, where exposure to SRC cases was limited and professional development was often self-initiated rather than embedded in institutional pathways. Some participants attributed their increased confidence to continued exposure and informal learning, while others highlighted the absence of structured SRC-specific training during their education. These findings align with broader issue in knowledge translation, defined as the process by which evidence-based findings are transferred from knowledge to practice (189). In the context of SRC, knowledge translation was hindered not by a lack of available evidence but by limited educational infrastructure, resource constraints, and contextual pressures within sport. The absence of mandated SRC

training or ongoing professional education contributes to the fragmented implementation of care. Some participants described seeking out resources independently, reflecting a systemic shortfall in the formal integration of SRC education for healthcare professionals. These patterns are consistent with the Knowledge-to-Action (KTA) Framework, which emphasizes that disseminating knowledge alone is insufficient; successful implementation requires adapting to the context, engaging actively with knowledge users, and establishing iterative feedback loops (23). Within SRC, where protocols and research evolve rapidly, this framework is particularly relevant. Importantly, within this framework, it is emphasised that as knowledge is updated, barriers to this knowledge must be reconsidered (189). This is particularly important in SRC, where knowledge and best practices continue to evolve.

Overall, this study suggests that improving SRC education requires more than disseminating information. It involves embedding concussion knowledge into the everyday realities of sport medicine practice through structured training, reflective learning, and the ongoing integration of updated research into meaningful clinical action. These findings can also be interpreted through Bronfenbrenner's Ecological Systems Theory, which conceptualises human behaviour as shaped by nested and interacting systems (190). At the microsystem level, individual clinicians are responsible for engaging with evidence and maintaining competence. However, the meso and exo-system levels, including clubs, multidisciplinary teams, and organisational leadership, influence whether education is prioritised, resourced, and reinforced in practice. At the macrosystem level, governing bodies, policymakers, and consensus groups shape the broader regulatory and cultural expectations surrounding SRC management. Viewed through this lens, gaps in education and implementation cannot be reduced to individual shortcomings, rather, they reflect uneven

alignment across interconnected systems that structure how SRC knowledge is translated into everyday clinical care.

8.2.4 Organisational Pressures and Inconsistent Care

Organisational and environmental pressures emerged as significant influences on SRC management. These pressures were not merely logistical, but deeply embedded in the culture, expectations, and structures of sport. Clinical decisions were shaped by factors such as performance demands, resource availability, and the implicit rules of the sport itself. These findings align with literature highlighting the unique challenges of sports medicine, where professionals must balance their obligations to athlete health with overlapping interests to the team (191). Formal SRC diagnosis often triggered mandatory return-to-play protocols, creating tension with coaches, athletes, or management concerned about player availability. This rigidity left practitioners negotiating between medical judgment and external pressures, especially where flexibility was lacking. While participants consistently prioritised athlete safety, they acknowledged that clinical autonomy was sometimes compromised by contextual realities. These examples reflect what can be described as the "culture of risk" in elite sport, a phenomenon where athletes internalise the expectation to play through pain and injury (192). With SRC, this can be especially problematic given the invisible nature of the injury and the subjectivity of symptoms. Such dynamics complicate efforts to ensure accurate reporting and consistent application of SRC protocols. Finally, organisational context influenced care standards across competition levels. Participants noted disparities in SRC management, with elite athletes often receiving expedited access to care. In sum, SRC care is not solely shaped by clinical guidelines, but also by the cultural, structural, and relational forces that define a sporting environment.

8.2.5 Integrating Athlete-Centred Approaches into SRC Management

Beyond structural and educational challenges, participants frequently identified the practitioner–athlete relationship as central to effective SRC care. Across interviews, participants emphasised the importance of trust, communication, and transparency, principles aligned with athlete-centred or patient-centred models of care (193). These findings are consistent with broader healthcare literature, which highlights the value of clinician–athlete rapport in promoting engagement, adherence, and recovery (193, 194). Evidence also shows that empathy, communication, and approachability are essential components of effective clinician–athlete relationships, contributing to improved treatment outcomes (193, 194). These principles reflect many of the relational strategies described by participants in this study, where trust and understanding facilitated more honest communication, reduced resistance, and supported athlete adherence to SRC protocols. Within sports medicine specifically, Ardern et al. argue that RTP decisions should be situated within a broader athlete-centred framework that combines psychological readiness, performance execution, and additional factors when considering athletic decisions (195).

These themes also intersected with the broader concept of holistic care. SRC was not perceived as an isolated injury but one with potential implications for mental health, athletic identity, and long-term performance. Participants suggested that building rapport enabled them to have more candid conversations about symptoms and recovery, reduce stigma, and tailor interventions in ways that acknowledged the psychological dimensions of rehabilitation. Athlete-centred care was therefore framed not only as a relational asset but also to promote more nuanced, effective, and compliant SRC management.

Embedding these relational and holistic principles into SRC policy and education may help bridge gaps between protocol and practice. Athlete-centred care supports flexibility in recovery timelines, encourages reflective practice, and ensures that return-to-play decisions are guided not just by symptom resolution, but by athlete readiness and broader wellbeing.

8.2.6 Navigating Uncertainty and Diagnostic Ambiguity in SRC

A persistent challenge in SRC management is the inherent diagnostic uncertainty surrounding the condition. Unlike musculoskeletal injuries, which are often confirmed through imaging or observable tissue damage, SRC relies heavily on subjective symptom reports, clinical judgment, and behavioural observation. This lack of objective diagnostic tools complicates decision-making and increases pressure on practitioners, particularly in high-stakes or time-sensitive sport environments. Participants across the study described how this ambiguity contributed to hesitancy, both in making a definitive diagnosis and in determining when to initiate or withhold care. These perspectives are supported by literature on diagnostic uncertainty, which suggests that uncertainty is not only inherent to medical practice but particularly pronounced in the management of SRC (164). Even among more experienced professionals, this uncertainty was not necessarily resolved but rather better managed through reflective practice and contextual judgement. Malcolm's work highlights how clinicians, operating under epistemological, clinical, and existential uncertainty, often adapt their treatment practices in response to social dynamics and performance pressures within sport environments (164). In some cases, participants indicated that this ambiguity carried emotional weight, as decisions about SRC were tied to athlete safety and organisational expectations. The invisible and fluctuating nature of symptoms further complicated communication with athletes, coaches, and stakeholders. Practitioners described the difficulty of navigating pushback, especially when athletes appeared outwardly healthy

but reported subtle or inconsistent symptoms. Taken together, this theme reinforces that SRC is not only clinically ambiguous but socially and emotionally complex. The findings here point to a broader need to support clinicians not only in identifying SRC, but also in managing the uncertainty it brings to their practice.

8.3 Limitations and Future Directions

8.3.1 Study Limitations

Despite these findings**,** there were notable limitations that must be acknowledged. As is common in qualitative research, the findings reflect the situated experiences of a specific group of participants, shaped by context and perspective (20). The participant sample was relatively small and drawn from networks within the U.K. Within an interpretivist framework, the intention of this study was not to generate definitive or universally applicable conclusions, but to develop a contextually grounded understanding of how practitioners conceptualise and navigate SRC management within high-performance environments (21). Consequently, the findings should be interpreted as reflective of the perspectives and experiences of this specific practitioner group rather than as a comprehensive representation of SRC management practices across all sporting environments. The insights generated therefore provide interpretive depth into how SRC guidance may be navigated within high-performance contexts, while recognising that alternative organisational structures, sporting cultures, or practitioner roles may produce different experiences of SRC management. Although multiple recruitment methods were attempted, including outreach via professional networks, flexible scheduling options, and offering in-person, online, and focus group formats, participants overwhelmingly opted for digital one-on-one interviews. The difficulty in securing participants may reflect the time constraints of professionals working in high-

performance sport and potential discomfort in discussing SRC knowledge within an interview setting.

All participants in this study were male. Inevitably, this shaped both the data generated and the interpretive lens through which SRC management was discussed. High-performance sport medicine operates within often male-dominated environments, and gender may influence perceptions of authority, communication, confidence, and relational negotiation (196). The absence of female practitioner perspectives means that alternative experiences of navigating SRC care within elite sports were not directly represented in this analysis. Additionally, the diversity of interviewees' backgrounds posed challenges in establishing a cohesive, sport-wide perspective. For instance, within the small sample, some participants were new to SRC management, while others worked within a single sport, reflecting the context-specific nature of the accounts generated. Through an interpretive lens, the findings are context-bound and not statistically generalisable. While the study aimed to explore depth over breadth, future research may benefit from broader sampling across sport contexts to widen the range of perspectives represented.

Data was generated through single, one-off semi-structured interviews. While this approach enabled focused and in-depth exploration, it did not allow for iterative engagement, or a longitudinal development of participant perspective over time. As a result, opportunities for returning to participants for refinement of interpretation or deepening of emergent themes were limited. A reflexive approach, inclusive of a reflexive research journal and consistent team collaboration, was used throughout the project to acknowledge and critically examine the influence of the researcher's background, particularly during coding and theme development (see Appendix XII). However, a broader and more varied sample may have

further added to the diversity of perspectives represented, potentially offering a more widely applicable view of SRC management.

Reflecting on these challenges, several lessons emerge. Future research may benefit from alternative recruitment strategies, such as survey-based initial engagement to encourage broader participation, followed by targeted follow-up interviews or focus groups. Additionally, reconsidering the framing of study invitations to avoid potential perceptions of a knowledge assessment may improve recruitment success. These reflections reinforce the importance of adaptability in research design and provide a foundation for future investigations into SRC policy implementation and practitioner attitudes. Additionally, the sample reflects a greater proportion of practitioners from cricket, rugby, and combat sports, meaning certain sporting contexts are more strongly represented in the findings. While the study aimed to explore depth over breadth, future research may benefit from broader sampling across underrepresented sports or international contexts. Attention to these gaps would not only improve generalisability but also help identify potential differences in SRC approaches across diverse sporting structures. Though reflexive practice was used, the researcher's background and familiarity with high-performance sport may also have shaped the lens through which participant narratives were interpreted.

While limitations exist, the strength of the data analysis approach ensures that meaningful insights were still extracted. This research should be understood as an initial exploration of SRC management challenges among a specific practitioner group. Future studies could build on this foundation by examining variations in SRC implementation and practitioner decision-making across sports, regions, and roles, with the aim of informing more context-sensitive concussion education and protocols.

8.3.2 Future Research

To better capture the breadth of SRC management across sporting environments, future studies should aim for broader participant representation and explore how SRC care is navigated across a wider range of sports and cultural contexts. Comparative research examining how practitioners in different countries interpret and apply SRC protocols may reveal regional variations in SRC education, pressure, and implementation. One potential avenue may involve partnerships with national governing bodies, practitioner networks, or education providers to facilitate access and engagement. Future research should also consider multi-perspective designs, integrating the experiences of athletes, coaches, and support staff alongside clinicians. This approach could provide a more holistic understanding of the cultural and relational dynamics influencing SRC care. Given the significance of trust, communication, and relational confidence in this study, further exploration into athlete–practitioner dynamics may be particularly meaningful. Finally, given the ongoing evolution of SRC research and consensus statements, future work should investigate how clinicians interpret, adapt, and integrate emerging recommendations in real-time, especially when guidelines shift or become updated.

8.4 Conclusions

This study set out to explore the current approaches and attitudes of MPs working with high-performance athletes toward the diagnosis, treatment, and management of SRC. Through reflexive THEM-A of six in-depth interviews, the research identified multiple interacting influences on SRC care, including the unique contexts surrounding SRC, educational barriers, evolving practitioner confidence, and the critical role of relational trust. The findings contribute to both academic literature and practical dialogue around SRC

management. They highlight how clinical decision-making is shaped not only by protocols and training, but by interpersonal dynamics, institutional pressures, and the often-ambiguous nature of SRC itself. Participants described how these factors intersect in ways that complicate consistent care, particularly in performance-driven environments. While limited in scope, this project offers valuable insight into the lived realities of practitioners tasked with managing one of sport's most complex injuries. In a context where expectations are high, symptoms are invisible, and decisions carry both medical and performance consequences, the study underscores that effective SRC care is not simply a matter of protocol, but one shaped by individuals, systems, and trust.

CHAPTER FOUR: Synthesis and Discussion

Section 9 - Combined Projects

9.1 Introduction

SRC's continue to pose a significant concern across all levels of sport, from youth to elite professional competition (197, 198). Among collegiate athletes, the concussion rate has been estimated at 4.13 per 10,000 athlete-exposures (AEs), with the highest rates observed in men's ice hockey (7.35 per 10,000 AEs) and women's soccer (7.15 per 10,000 AEs) (199). At the professional level, a 5-year epidemiological review of NFL data identified 1,302 SRC among 1,004 players, with 80% occurring during games. The overall SRC rate in regular season games was 1.70 per 10,000 player-plays, with the highest rates observed during kick-off plays and among tight ends and wide receivers (200). These figures underscore the ongoing need for robust, evidence-informed approaches to concussion prevention, recognition, and management.

This chapter synthesizes findings from the two interrelated components of this dissertation: a PRISMA-ScR of international SRC guidelines and a qualitative study exploring how MP's approach SRC in high-performance sport. Together, these projects provide both a system-level and practitioner-level perspective on the current state of SRC management. This chapter explores how the two data sets reinforce or contrast with one another, reflects on methodological choices, discusses limitations, and offers recommendations for future research and policy development.

9.1.1 Overview of Included Studies

This dissertation draws on two interrelated studies to examine SRC management from both a system and practitioner level. The first, a scoping review of 115 sources across 22 sports, mapped the breadth and variability of existing SRC policies, protocols, and guidelines. Key findings revealed considerable inconsistency across documents, with wide variation in the inclusion of core SRC components such as definitions, return-to-play protocols, sideline evaluations, and guidance for persistent symptoms. While some high-performing nations demonstrated comprehensive policy coverage, others lacked basic recommendations or omitted athlete-centred care entirely. The review identified five major domains: *Purpose and Scope, Prevention Measures, Sideline Evaluation and Diagnosis, SRC Management Strategies,* and *Follow-Up Care and Prognosis*.

The second study explored how MPs working in high-performance sport understand and implement SRC care. Four major themes were identified: *Barriers to Effective SRC Management, Practitioner Confidence in SRC Management, Variability in SRC Understanding,* and *Inconsistency Within SRC*. Participants highlighted the influence of performance pressures, interpersonal dynamics, and organisational constraints in shaping their clinical decisions. Many described a tension between protocol adherence and athlete needs, particularly in environments with limited guidance or support.

Together, the findings provide insight into how SRC is managed at the policy level and how it is enacted in clinical settings, underscoring the need for more adaptable, context-sensitive approaches to education and policy.

9.2 Synthesis of Key Findings

9.2.1 Main Findings from Scoping Review

The PRISMA-ScR examined 115 documents from 15 different sports, spanning both national and international governing bodies. Using a structured TEMP-A framework, five major domains were identified across the data set including *Purpose and Scope, Prevention Measures, Sideline Evaluation and Diagnosis, SRC Management Strategies,* and *Follow-Up Care and Prognosis*. Across these domains, several key patterns emerged. First, there was no unified operational definition of SRC, and terminology varied considerably between documents. Second, audience targeting was often unclear, with many guidelines failing to distinguish between HCP, coaches, athletes, or stakeholders, limiting their utility in practice. Third, while RTP protocols were included in many sources, their structure and enforcement varied widely, with only some specifying steps for medical clearance or defining minimum recovery timelines. Sideline evaluation protocols and assessment tools also differed in depth and clarity. In terms of preventative strategies, education was frequently emphasized but rarely supported by enforceable policies. Finally, follow-up care for persistent symptoms was inconsistently addressed, with very few documents offering detailed guidance on multidisciplinary referral or long-term management. Together, these findings highlight the fragmented and variable nature of SRC policy across the global sporting landscape.

9.2.2 Main Findings from Qualitative Study

The qualitative study explored the experiences and perspectives of six HCP working in high-performance sport settings. Participants brought varied expertise and provided insights into how SRC is diagnosed, interpreted, and managed in real-world contexts. Four major themes emerged from the data:

1. **Barriers to Effective SRC Management**: Participants described the unique nature of SRC, gaps in education, issues with symptom-centric medical care, and uncertainty within the field, all of which could complicate or undermine SRC care.
2. **Practitioner Confidence in SRC Management**: Confidence was shaped by both clinical experience and interpersonal dynamics. Some participants described growing more confident with experience, while others found confidence through shared decision-making, especially when dealing with ambiguous contexts.
3. **Variability in SRC Understanding**: Practitioners described factors that contribute to the complex understanding of SRC. Definitions of SRC varied between individuals, relying on either personal experience or external guidelines. Understanding of the condition varied between participants primarily due to differences in clinical experience.
4. **Inconsistency Within SRC**: Across diagnostic, treatment, and RTP pathways, participants noted inconsistencies between different teams, sports, or professional standards. Several highlighted frustrations with the lack of coherence in how SRC is approached across contexts.

Subthemes added further nuance, including the overreliance on tools like SCAT by newer professionals, differences between relational and clinical confidence, and the need for a more holistic view of concussion as a dynamic and individualized injury.

9.2.3 Combined Insights

Taken together, the findings from the scoping review and qualitative study provide a layered understanding of how SRC is both formally structured and practically experienced.

The scoping review mapped system-level patterns in SRC policy and protocol development, revealing wide variation in how key components, such as definitions, RTP procedures, and education, are addressed. Meanwhile, the qualitative data offered insight into how MPs interpret and apply those components on the ground. When read in tandem, the two studies expose critical points of disconnection between policy intentions and practical realities.

One of the clearest intersections between the studies is the role of education. Across both datasets, educational efforts were frequently named as essential to improving SRC prevention and management but were either vaguely defined or inconsistently operationalised. In the scoping review, education was often included as a recommended prevention strategy, yet few documents detailed how this education should be delivered, evaluated, or adapted across different sporting contexts. Similarly, interview participants described gaps in SRC training and ongoing professional development. Some relied heavily on tools like SCAT due to limited formal instruction, while others developed confidence over time through trial, error, and interpersonal learning. These insights reinforce existing concerns that SRC education programmes are often delivered without context-specific implementation strategies or sustained evaluation, which limits their effectiveness as tools for knowledge translation (201).While policy documents may promote education, the qualitative findings reveal that implementation depends heavily on institutional resources, interpersonal trust, and informal networks of support.

Both studies also highlighted a lack of definitional clarity around SRC. The scoping review found inconsistent terminology and divergent definitions across national and international documents. Meanwhile, MPs described SRC as invisible, evolving, and often misunderstood. This ambiguity in the injury diagnosis undermined diagnostic confidence and

adherence to protocol. Participants expressed hesitancy when defining the injury, noting that some symptom presentations were unclear or difficult to categorise. These findings echo broader concerns in the literature, where scholars have highlighted the persistent confusion surrounding concussion terminology and its impact on diagnosis, public communication, and care pathways (28, 202). When policies fail to provide stable conceptual foundations, clinicians are left to navigate grey areas under pressure, an issue reflected in both formal policy gaps and the lived experiences of practitioners. This conceptual gap may stem from multiple sources. First, SRC science remains dynamic, with evolving consensus statements, emerging diagnostic tools, and ongoing debate regarding mechanisms, thresholds, and definitional parameters (79, 84, 118). Second, policy language is often shaped by medical and legal considerations, and when intersected with a syndrome lacking pathological clarity, it emphasises deliberately flexible wording (28). Finally, SRC guidance exists within broader sociopolitical landscapes, where sporting organisations must balance athlete welfare, educational resources, and regulatory compliance. In this context, conceptual ambiguity may reflect not only scientific uncertainty, but considerations of how guidance is constructed and applied in practice.

Another key area of intersection lies in the structuring and enforcement of SRC protocols. The scoping review revealed variability in how RTP timelines, sideline assessments, and persistent symptom protocols were articulated. While some documents clearly outlined progressive staging and clinician discretion, others were vague or rigid, with limited adaptation for context, sport, or athlete-specific factors. In the interview study, MPs described working within these constraints while navigating real-world complexity. Rather than outright deviating from protocols, participants expressed frustration with the rigid application of timelines, particularly when symptoms were ambiguous. These reflections did

not reject formal guidance, but instead emphasised the importance of adaptability, trust, and individualised care, particularly in performance-driven environments. This reinforces calls in the literature for more relational, context-sensitive, and athlete-centred approaches to SRC care that accommodate individual variability rather than impose universal timelines (203). When taken together, the two studies suggest that SRC management cannot be divorced from the environments in which it occurs.

Importantly, this dissertation also illustrates how system-level variability and practitioner-level uncertainty may reinforce one another. Several senior participants described the value of experiential learning and interpersonal dynamics over rigid policy adherence. Rather than abandoning formal guidance, they drew on experience, peer input, and athlete feedback to inform decisions when policy felt incomplete. By contrast, novice professionals often relied on protocols as anchors, finding comfort in their structure amidst uncertainty. This divergence contributed to variability in confidence and care delivery, particularly in performance-driven environments. This finding resonates with the KTA framework emphasises that knowledge implementation is a dynamic, iterative process dependent not only on dissemination, but also on contextual adaptability, end-user involvement, and real-world relevance (23). Without consistent policy scaffolding and implementation support, practitioners are left to improvise care based on experience, peer influence, or institutional culture.

The integration of findings here suggests that refining SRC management requires more than standardising protocols. It necessitates sustained investment in education that is adaptable, iterative, and responsive to the lived realities of sport. It also requires clearer definitional foundations that account for clinical ambiguity while still guiding action.

Moreover, it depends on system structures that enable practitioner judgment and relational trust. By mapping this disconnect between protocol and practice, the research offers a foundation for more integrated, evidence-informed approaches that align policy with the complexities of care on the ground.

9.2.3.1 Sociological Implementation and Standardisation

The combined insights suggest that inconsistency and ambiguity in SRC guidance are not only matters of document quality, but a consequence of how SRC management is socially organised across sporting systems. A socioecological perspective provides a useful framework for understanding this complexity. Bronfenbrenner's socioecological model positions individual behaviour within nested micro, meso, exo, and macro levels that each interact to influence overarching elements such as individual clinicians and athletes, interpersonal dynamics, organisational structures, and governance (190). Rather than assuming that guideline implementation and standardisation is a linear process of knowledge transfer, this framework highlights that practice unfolds within layered environments that both enable and constrain action. Applied to the landscape of SRC guidance, this model clarifies that implementation does not depend solely on clinician knowledge or policy clarity. At the micro level, clinicians and athletes independently interpret symptoms, risk, and evaluation of the environment. At the meso level, trust, disclosure, and interpersonal negotiation shape decisions about removal, disclosure, and RTP. Within the qualitative data, tension emerged around decision-making in practice, while confidence developed within their interpersonal environments. At the exo level, organisational structure, such as removal policy, substitutions, and sport culture shape what SRC guidance appears as feasible. Finally, at the macro level, consensus statements, league mandates, and varying frameworks define

the outer boundaries of practice. Implementation of this guidance is therefore not a singular event, but a socially mediated process across many levels (190).

This layered interpretation helps explain why many SRC guidelines appear to target a general audience simultaneously. In Chapter Two, inconsistent audience targeting was observed, with documents blending clinical direction, educational messaging, and governance principles within a single resource. In Chapter Three, this translated into practical difficulties: HCP described navigating their roles, performance pressures, and athlete expectations while attempting to provide the best care. When a single document attempts to address clinicians, coaches, administrators, and athletes at once, role accountability can become diffuse. Ambiguity may therefore not reflect conceptual weakness, but the structural challenge of writing guidance that is intended to operate across multiple socioecological layers.

This sociological lens on the landscape of SRC further reinforces this interpretation. Malcolm's analysis of the medicalisation of SRC demonstrates how concussion governance has increasingly consolidated medical authority through consensus statements and standardised tools, positioning medicine as the central referee of brain health in sport (204). At the same time, his work illustrates that clinical autonomy is continually negotiated within sporting hierarchies (204). Baseline testing is promoted but limited; there are pressures within RTP; and clinicians report diagnostic uncertainty despite formal protocols. These findings reveal that SRC management is embedded within interpersonal dynamics, organisational and sporting culture, and medical uncertainty. Guidelines aim to articulate best practice, but their enactment is mediated by social structures that cannot be reduced to compliance versus non-compliance.

This perspective also assists in interpreting and operationalising what “standardisation” can realistically mean. The PRISMA-ScR identified repeated calls for consistent definitions, RTP structure, and sideline processes, however, the qualitative findings demonstrate that rigid protocol application can be mismatched to real-world comprehension, athlete needs, and sport demands. True standardisation is therefore not a simple goal of making SRC management identical across all sports and contexts, neither is it realistic or clinically appropriate given the inherent variability of SRC as a syndrome. Diagnostic uncertainty, evolving symptoms, and contextual pressures, makes uniformity unattainable at the level of individual care. Rather, ‘standardisation’ should operate at the level of minimum ethical and procedural safeguards rather than identical execution. Certain elements are ethically non-negotiable: immediate removal following SRC suspicion, prohibited same-day RTP, graduated RTP plans, and medical clearance prior to full return. These components represent baseline protections that are meant to mitigate preventable harm. However, the mechanisms by which these standards are operationalised, such as monitoring strategies, substitution policies, education delivery, and documentation processes, will necessarily vary across sports, competition levels, and environments.

Through the socioecological lens, the question shifts from whether SRC management can be standardised, to which components can and should be standardised across macro structures, and which must remain adaptable within meso and exo level realities (190). Attempts to impose complete uniformity risk obscuring contextual constraints and may inadvertently produce insufficient compliance rather than meaningful protection and changes within SRC landscape. By contrast, defining enforceable minimum standards while acknowledging ecological variability offers a path toward alignment between policy and lived practice. Taken together, this analysis suggests that ambiguity within SRC guidance is

not a failure of clarity. It reflects the structural complexity, as seen through the PRISMA-ScR, of governing an injury that is simultaneously medical, social, ethical, and organisational.

Recognising this complexity allows for a reframing of implementation challenges, not due to practitioner reluctance or policy insufficiency, but as the predictable outcome of multi-level systems interacting in sport. While the socioecological model clarifies the structural layers within which SRC management unfolds, it does not fully account for how authority, influence, and decision-making are negotiated within and across those layers. A micropolitical perspective provides further explanatory depth. While Bronfenbrenner's model clarifies the layers, micropolitics offers insight into how power operates within and across these layers (190, 205). Sport organisations have been described as contested and negotiated environments operating within situational constraints, where power is characterised by a dynamic "play of powers" rather than a fixed authority (205). Within this framework, micropolitics refers to the formal and informal use of power by individuals and groups to achieve their goals (205). Complementing this, policy in sport has been conceptualised as something enacted through micro-political and emotional processes rather than mechanically implemented (206).

When applied to SRC guidance, this suggests that guidelines function not as fixed scripts but as resources to be interpreted, negotiated, and operationalised within performance-driven systems. In high-performance sport, protocol enactment is therefore shaped by everyday relational work. Variability in SRC management reflects not only structural differences in guideline design, but the interpersonal interaction through which policy and guidance are translated into clinical practice. As described in the qualitative findings,

practitioners navigated performance pressures, maintained athlete trust, and balanced clinical caution. These dynamics reflect micropolitical processes in action, where authority is exercised, challenged, and sustained through interaction rather than assumed through role alone.

9.3 Contributions to Research and Practice

This dissertation offers several conceptual contributions to the field of SRC management. Together, the two studies highlight how systemic variability and practitioner uncertainty can interact in ways that complicate consistent care. Drawing on the scoping review, the research identifies structural inconsistencies in definitions, RTP protocols, and educational guidance. These gaps mirror findings from the interview study, where participants described uncertainty, hesitancy, and a reliance on informal learning through clinical experience. One conceptual contribution is the identification of a feedback loop between incomplete policies and practitioner-level care. Practitioners, especially those newer to the field, often leaned on standardised tools or rigid timelines in the absence of clear institutional direction. Others drew on interpersonal trust, experiential knowledge, and athlete input to make case-specific decisions. This pattern reinforces the notion that knowledge translation in SRC is not simply a matter of dissemination, but of dynamic interaction between evidence, context, and clinical judgment. These insights conceptually complement the KTA framework, which emphasises that the translation of evidence into practice requires more than dissemination; rather, it depends on context-sensitive strategies and engagement with end-users (23). While the KTA framework outlines general principles of implementation, these studies build on that foundation by combining practitioner-informed perspectives with a system-level analysis of current SRC guidance. The two studies presented

here extend this work by illustrating how the “action” component of the KTA cycle can be obstructed by inconsistent definitions, underdeveloped education strategies, and institutional cultures that undervalue relational trust. In this way, the research provides a practitioner-informed lens on where and how SRC protocols fall short in real-world contexts. Additionally, this dissertation contributes to growing scholarship on the emotional, contextual, and relational dimensions of SRC care. Across both studies, SRC emerged not as a singular condition with a clear course of action, but as a dynamic and often ambiguous injury requiring nuanced, athlete-centred responses.

This work reinforces the conceptual importance of adaptability, not just in protocol design, but in how care is enacted and interpreted on the ground. By mapping the disconnect between formal systems and lived practice, the research underscores the value of integrating both system-level and practitioner-level perspectives to guide future research, policy development, and education design. These conceptual insights carry practical weight. By showing how protocols are negotiated, interpreted, or even resisted in real-world contexts, the research suggests that implementation efforts must move beyond static checklists. Relational dynamics, institutional culture, and clinical judgement are not peripheral, they are central to how SRC care unfolds. Designing effective policy, therefore, means embedding flexibility, supporting practitioner education that evolves with sport-specific needs, and developing infrastructure that encourages transparency, trust, and shared decision-making.

9.4 Future Directions

This dissertation highlights the ongoing challenge of managing SRC in a way that balances clinical standardisation with the heterogeneous and evolving nature of the injury. The findings demonstrate that SRC is not a uniform event, but a condition marked by variable

symptoms, recovery trajectories, and contextual contingencies. Future research must continue to grapple with this tension by designing guidance and educational strategies that accommodate individual differences while supporting clinical consistency.

One priority for development is the creation of flexible and tiered protocol frameworks that balance clarity with adaptability. These frameworks should enable clinical decisions to be adjusted based on athlete history, sport-specific demands, and practitioner expertise, especially in contexts where specialist care may be inaccessible. Both the scoping review and qualitative findings suggested that universalised SRC management can overlook nuances in sporting environments and injury contexts. While several documents referenced elite-level RTP pathways, few addressed how guidance should be adapted when resources are constrained. This concern was echoed in the interview study, where one participant questioned why elite athletes were permitted to follow shortened RTP timelines. These insights support broader calls for more nuanced, athlete-centred approaches to SRC protocol design (5, 193).

A second area requiring attention is the design and delivery of SRC education. The research identified a recurring disconnect in how education is delivered and internalised across practitioner career stages. Newer professionals tended to rely heavily on standardised tools like SCAT in the absence of formal instruction, while more experienced practitioners reflected critically on earlier knowledge gaps and emphasised the value of interpersonal learning. The interview findings pointed to peer dialogue, informal mentoring, and ongoing engagement with research as drivers of professional interest in SRC. These patterns suggest that education must not be static but evolve in ways that reflect changing practice demands. To remain clinically relevant, SRC guidance and educational resources must be updated at

least annually by sporting bodies, ensuring they reflect current evidence and evolving best practices. Future research should also evaluate how mentorship models, interprofessional workshops, and context-sensitive modules can promote SRC competency across settings. These efforts would benefit from implementation science frameworks (e.g., KTA), which emphasise usability, sustainability, and responsiveness to practitioner needs (23).

From a methodological perspective, the study underscores the need for longitudinal and mixed-methods research designs. Cross-sectional snapshots of protocol content or practitioner perspectives cannot fully capture how SRC decisions unfold or evolve. Studies that combine document analysis, practitioner interviews, and follow-up case tracking would help identify where breakdowns in implementation occur. For example, research might follow practitioners across a competitive season to observe how return-to-play decisions shift in response to symptom progression, institutional pressures, or resourcing. Similarly, real-time digital tracking of SRC cases could complement interviews by capturing behavioural patterns and providing insight into decision-making as it occurs.

Finally, future research should expand the stakeholder base. The interviews focused on practitioners, but athlete, coach, and administrative perspectives remain underexplored despite their influence on how SRC protocols are adopted or resisted. Broader engagement is also needed to support interdisciplinary collaboration across sport science, clinical medicine, psychology, and policy. As the findings suggest, effective SRC care is as dependent on system design and interpersonal trust as it is on clinical knowledge. Moving forward, research must centre not only on the what of SRC management, but the how, why, and who behind it.

9.5 Reflections

This research was shaped by the positionality of a researcher trained in kinesiology and sociology, with experience conducting supervised projects in biomechanics and sport psychology, and a background in competitive sport. While not embedded in clinical or coaching practice, familiarity with performance cultures informed the design of interview questions, the interpretation of practitioner narratives, and the identification of implicit themes. The analytic approach was further influenced by interdisciplinary training, which fostered sensitivity to both structural and interpersonal dimensions of SRC care.

Reflexivity was embedded throughout the research process, including during the development of the coding template, interpretive decision-making, and supervisory debriefs. Early engagement with the qualitative literature and methodological guidance on reflexive THEM-A encouraged deliberate attention to assumptions, positionality, and the risk of projection during theme development. Memos and journaling were used to document analytic choices and surface emerging biases. The iterative nature of the analysis supported this process by enabling ongoing adjustment of codes in response to deeper engagement with the data.

This position, situated between academic, athlete, and outsider to clinical practice, offered both strengths and limitations. While it allowed for critical reading of policy discourse and practitioner experience, it may also have shaped the types of questions asked, the themes prioritised, and the interpretations advanced. These reflections aim to strengthen

the transparency of the research process and clarify the contextual lens through which findings were produced.

9.6 Conclusion

This dissertation offers a mixed-methods contribution to the study of SRC management. The scoping review systematically mapped existing SRC documentation, revealing structural inconsistencies in definitions, RTP protocols, audience targeting, and follow-up care. In parallel, the qualitative study captured the lived experiences of HCPs navigating SRC management in high-performance sport. Together, these projects demonstrate not only what is written in policy, but also how that guidance is interpreted, negotiated, or resisted in practice.

While SRC is inherently heterogeneous, marked by variable symptoms, evolving recovery, and athlete-specific factors, clinicians remain tasked with delivering appropriate care (1, 6, 165). The findings suggest that effective SRC management cannot rely solely on prescriptive frameworks. Rather, it requires a systems-based approach that integrates interdisciplinary expertise, accommodates local constraints, and fosters relational trust between stakeholders. The use of structured evidence mapping alongside reflexive qualitative analysis enabled a more holistic understanding of how SRC guidance is both constructed and enacted. Importantly, this research supports broader findings in implementation science that highlight how policy-practice gaps often arise not from the absence of evidence, but from insufficient translation into usable, context-sensitive formats (23, 189, 207).

The impact of this work lies in its dual-pronged approach. By documenting the state of SRC policy while also exploring the realities of implementation, this dissertation advances

understanding of where SRC care succeeds, where it falters, and where it must evolve. In a field marked by uncertainty, this research offers a foundation for rethinking how we educate, regulate, and support those responsible for athlete wellbeing.

SUPPLEMENTARY MATERIAL

Appendix I: List of Sports

- General Sport
- Auto Racing & F1 Racing
- Australian Rules Football
- Baseball
- Basketball
- Boxing
- Cricket
- Cycling/Biking
- Equestrian Sports
- Field Hockey
- American Football
- Football
- Ice Hockey
- Judo
- Karate
- Kickboxing
- Lacrosse
- Mixed Martial Arts
- Rugby
- Softball
- Taekwondo
- Volleyball
- Wrestling

Appendix II: Search Strategy

9.7 Full Search Strategy

The search strategy is described within multiple phases, as per the JBI manual recommendations (30). In line with JBI guidelines, phase one involved identifying key words based on field knowledge, conducting an initial search, and analysing the titles, abstracts, and index terms of relevant papers. This helped build a comprehensive, database-specific search strategy. Phase two focused on executing tailored searches for each database. The search began on October 24th, 2024, and included published evidence from the last decade, specifically between 2014 and 2024, with no language restrictions applied. This strategy outlines the complete search protocol for the PubMed database.

9.7.1 Phase One of Search Strategy

Protocol of search for initial key words was guided by the SRES librarian. Firstly, looking at the research question, the key terms (e.g., 'concussion', and 'protocol') were identified. From there, synonyms and other familiar nomenclature were identified. These synonyms were then placed together so that Boolean operators could be easier to organize. Following this, identification of additional key words was done through cross analysis of PMID identification numbers through the Yale MeSH Analyser tool (40). The PMID numbers of major concussion guideline evidence was used, namely the CISG consensus statement and the ACRM Diagnostic Criteria (1, 4).

1. **Initial Keyword Isolation and Synonyms**

    i) Keyword: 'Concussion'

        (1) Synonyms of Keyword: 'mild traumatic brain injury', 'mTBI', 'head injury', 'brain injury', etc.

    ii) Keyword: 'Protocol'

        (1) Synonyms of Keyword: 'guideline', 'policy', 'guidance','recommendation','instruction','suggestion','regulation', etc.

2. **PMID Yale MeSH Analyser Search**

    i) CISG PMID: 37316210

    ii) ACRM Diagnostic Criteria PMID: 37211140

3. **Resulting Keywords**

    i) PMID Keywords: 'brain concussion', 'athletes', 'sport', 'consensus', 'brain concussion/diagnosis', 'brain injuries/rehabilitation', 'concussion', 'diagnostic', 'rehabilitation'

The use of synonymous and overlapping terms such as ‘concussion’ alongside ‘mTBI’ and ‘TBI’ is due to the use of varying nomenclature across the field. Due to the specificity of the review and the objective aims, no additional terms were used. This search strategy allowed identification of evidence focusing on concussive policy, and guidelines specifically applicable to head injury within sporting context.

9.7.2 Phase Two of Search Strategy

The following search string was applied in PubMed to identify relevant literature: (concussion OR mild traumatic brain injury OR mild tbi OR mtbi OR tbi) AND (policy OR policies OR law OR laws OR legislation OR regulation OR guidelines OR recommendations) AND (professional sports OR elite sports OR advanced athletics) focusing on studies that discuss concussion protocols, guidelines, or best practices in the context of professional sports and elite athletes.

Adjustments were made for publication year (2014-2024), language, and evidence availability, with studies lacking full text or abstracts being excluded. Each component was refined based on the predefined protocol and inclusion criteria, with filtration conducted using PubMed's built-in filter option. All full search results were saved and exported to Rayyan™ for further screening. This process involves selecting ‘save’ and choosing ‘all results’ in the ‘PubMed’ format, which generates a downloadable file that can be opened in Rayyan™ or other compatible software. Rayyan™ provides a deduplication feature within the review process, grading similarities up to 100% and enabling manual filtering of potential duplicates.

Beginning with the initial screening phase, titles and abstracts were screened to quickly exclude irrelevant sources based on inclusion criteria, with Rayyan™ software used for additional duplicate removal if needed. Evidence meeting the criteria advance to the next phase. Rayyan™ enables labelling of evidence during the screening process with options such as "include," "maybe," and "exclude," along with the ability to specify reasons for inclusion or exclusion. For this review, exclusion reasons are noted, and evidence is categorized by type—such as consensus statement, policy, guideline, or grey literature—to support effective tracking. Following this phase, the second phase of screening began with full-text reviews. In this phase, sources passing the initial screening undergo a detailed full-text review to ensure relevance to the research objectives, verifying eligibility based on predefined criteria.

After completing the full-text screening, a manual search was conducted to identify additional relevant guidelines and policies that were referenced within the included studies. This step ensured the inclusion of key sources that were not initially retrieved during the database search, enhancing the comprehensiveness of the review.

Appendix III: PRISMA-SCR Manual Search Material

9.8 Manual Search Material

9.8.1 Included Sports

- General Sport
- Auto Racing & F1 Racing
- Australian Rules Football
- Baseball
- Basketball
- Boxing
- Cricket
- Cycling/Biking
- Equestrian Sports
- Field Hockey
- American Football
- Football
- Ice Hockey
- Judo
- Karate
- Kickboxing
- Lacrosse
- Mixed Martial Arts
- Rugby
- Softball
- Taekwondo
- Volleyball
- Wrestling

9.8.2 Included Countries

Table 9

Full list of included countries

Afghanistan	Ghana	Oman
Albania	Greece	Pakistan
Algeria	Grenada	Palau
Andorra	Guatemala	Palestine State
Angola	Guinea	Panama
Antigua and Barbuda	Guinea-Bissau	Papua New Guinea
Argentina	Guyana	Paraguay
Armenia	Haiti	Peru
Australia	Holy See	Philippines
Austria	Honduras	Poland
Azerbaijan	Hungary	Portugal

Bahamas	Iceland	Qatar
Bahrain	India	Romania
Bangladesh	Indonesia	Russia
Barbados	Iran	Rwanda
Belarus	Iraq	Saint Kitts and Nevis
Belgium	Ireland	Saint Lucia
Belize	Israel	Saint Vincent and the Grenadines
Benin	Italy	Samoa
Bhutan	Jamaica	San Marino
Bolivia	Japan	Sao Tome and Principe
Bosnia and Herzegovina	Jordan	Saudi Arabia
Botswana	Kazakhstan	Senegal
Brazil	Kenya	Serbia
Brunei	Kiribati	Seychelles
Bulgaria	Kuwait	Sierra Leone
Burkina Faso	Kyrgyzstan	Singapore
Burundi	Laos	Slovakia
Cabo Verde	Latvia	Slovenia
Cambodia	Lebanon	Solomon Islands
Cameroon	Lesotho	Somalia
Canada	Liberia	South Africa
Central African Republic	Libya	South Korea
Chad	Liechtenstein	South Sudan
Chile	Lithuania	Spain
China	Luxembourg	Sri Lanka
Colombia	Madagascar	Sudan
Comoros	Malawi	Suriname
Congo (Congo-Brazzaville)	Malaysia	Sweden
Costa Rica	Maldives	Switzerland
Croatia	Mali	Syria
Cuba	Malta	Tajikistan
Cyprus	Marshall Islands	Tanzania
Czechia (Czech Republic)	Mauritania	Thailand
Democratic Republic of the Congo	Mauritius	Timor-Leste
Denmark	Mexico	Togo
Djibouti	Micronesia	Tonga
Dominica	Moldova	Trinidad and Tobago
Dominican Republic	Monaco	Tunisia
Ecuador	Mongolia	Turkey
Egypt	Montenegro	Turkmenistan
El Salvador	Morocco	Tuvalu
Equatorial Guinea	Mozambique	Uganda

Eritrea Estonia Eswatini ("Swaziland") Ethiopia Fiji Finland France Gabon Gambia Georgia Germany	Myanmar (formerly Burma) Namibia Nauru Nepal Netherlands New Zealand Nicaragua Niger Nigeria North Korea North Macedonia (formerly Macedonia) Norway	Ukraine United Arab Emirates United Kingdom United States of America Uruguay Uzbekistan Vanuatu Venezuela Vietnam Yemen Zambia Zimbabwe

Appendix IV: Cross-Reference Spreadsheet

9.9 Microsoft Excel Cross-Referencing Spreadsheet

A condensed version of the cross-reference spreadsheet is presented here. This summarized image outlines the cross-referencing format used for all 194 countries and 22 sports, organized by the presence of concussion protocols. Red cells indicate no protocol, yellow cells represent general policies, and green cells denote sport-specific protocols. The full version is available upon request or accessible via: https://essexuniversity.box.com/s/m870svmi081lrpofpr4sr4hgrraa7ith .

COUNTRY	General Spor	Auto Racing/F1 F	Australian Ru	Baseball	Basketball	Boxing
INTERNATIONAL	N/A	FiA Concussion /	N/A	N/A	N/A	International
Afghanistan	N/A	N/A	N/A	N/A	N/A	N/A
Albania	N/A	N/A	N/A	N/A	N/A	N/A
Algeria	N/A	N/A	N/A	N/A	N/A	N/A
Andorra	N/A	N/A	N/A	N/A	N/A	N/A
Angola	N/A	N/A	N/A	N/A	N/A	N/A
Antigua and Barbuda	N/A	N/A	N/A	N/A	N/A	N/A
Argentina	N/A	N/A	N/A	N/A	N/A	N/A
Armenia	N/A	N/A	N/A	N/A	N/A	N/A
Australia	Concussion i	Motorsport Austr	AFL Concussi	Concussion i	Basketball Au	Concussion i
Austria	N/A	N/A	N/A	N/A	N/A	N/A
Azerbaijan	N/A	N/A	N/A	N/A	N/A	N/A
Bahamas	N/A	N/A	N/A	N/A	N/A	N/A
Bahrain	N/A	N/A	N/A	N/A	N/A	N/A
Bangladesh	N/A	N/A	N/A	N/A	N/A	N/A
Barbados	N/A	N/A	N/A	N/A	N/A	N/A

Figure 14: Section of SRC cross-reference excel sheet

Appendix V: Templates for Template Analysis

9.10 Initial Template for TEMP-A

Table 10

Initial template for TEMP-A using NVivo software

Top-Level Code	**Subcode**	**Nested Codes**
1. SRC Definition	**1.1** Explicit Definition Provided?	• Yes • No • Other
	1.2 Definition Summary	• Summary if Applicable
2. Purpose and Scope	**2.2** Intended Purpose	• Recognition, Management, RTP, etc.
	2.3 Guideline Alignment	• Does it reference CISG (various versions), Parachute Canada, etc.
	2.4 Target Audience	• *MP/HCP only* • *Athletes, Coaches, Referees, Stakeholders, etc.*
3. Prevention Measures	**3.1** Prevention Initiatives	• Mandatory training, pre-season education, awareness campaigns
	3.2 Equipment Recommendations	• Helmets, safety gear, mouthguards
	3.3 Rule/Policy Modifications	• Lower tackle height, head contact bans, protective rule changes
	3.4 Training Modifications	• Limiting contact drills, altered techniques

	3.5 Proactive Measures	• Emergency Action Plan(s) • Pre-season Testing (baseline)
	3.6 No Prevention Strategies Stated	• If Applicable
4. Sideline Evaluation & Diagnosis	**4.1** Sideline Evaluation Protocol Provided	• Yes • No
	4.2 Recommended Assessment Tools	• SCAT (various versions) • CRT (various versions) • Other Tools
	4.3 Immediate Removal from Play?	• Yes • No
	4.4 Medical Referral Requirement?	• Yes • No
	4.5 Emergency Protocols for Severe Injuries ('Red Flags')?	• Yes • No
	4.6 No Specific Sideline Protocols Stated	• If Applicable
5. SRC Management Strategies	**5.1** RTS/RTP Protocol Included?	• Yes • No
	5.2 Rest Time Specified?	• Yes (24-48 hours, etc.) • No
	5.3 Minimum Recovery Timeline Stated?	• Yes • No
	5.4 Medical Clearance Required?	• Yes • No
6. Follow-Up Care & Prognosis	**6.1** Guidelines for Persistent Symptoms?	• Yes • No

	6.2 Multidisciplinary/Interdisciplinary Referral Recommended?	• Yes • No
	6.3 No Long-term Care Information Mentioned	• If Applicable
7. Documentation & Compliance	**7.1** SRC Reporting Requirement?	• Yes • No
	7.2 RTS/RTP Tracking Requirement?	• Yes • No

9.11 Final TEMP-A Template

Table 11

Detailed view of final coding template for scoping review (TEMP-A)

Top-Level Code	**Subcode**	**Nested Codes**
1. Purpose and Scope	**1.1.** Document Type / Intended Purpose	• Protocol • Policy • Guideline • Informational Resource

	1.2. External Standards	• CISG
		  ▪ 2022 Amsterdam
		  ▪ 2017 Berlin
		• Other External Guidance

	1.3. Target Audience	• MP/HCP • Mixed Audience

	1.4. SRC Definitions	*N/A*
	1.5. Semantics and Terminology	• "If in doubt, sit them out" • Interchangeable terminology • Other
	1.6 Compliance and Documentation Requirements	• Reporting/Tracking Requirements • Other Requirements
2. Prevention Measures	**2.1** Prevention Initiatives	• Mandatory Training • Educational Material/Initiatives
	2.2 Equipment Use Recommendations	*N/A*
	2.3 Rule and Policy Modifications	*N/A*
	2.4 Training Adjustments	*N/A*
	2.5 Proactive Measures	• Emergency Action Plan • Pre-Season Measures
3. Sideline Evaluation and Diagnosis	**3.1** Sideline Evaluation Protocol	*N/A*

	3.2 Recommended Assessment Tools	• SCAT
		  ▪ SCAT 5/6
		  ▪ Other
		• CRT
		• Other Tool(s) Specified

	3.3 Removal from Play	*N/A*
	3.4 Referral to MP/HCP	*N/A*
	3.5 Emergency Guidance	*N/A*
	3.6 Same-Day RTP	*N/A*
	3.7 Diagnostic Requirements for SRC	• Medical Diagnosis Required • Other
4. SRC Management Strategies	**4.1** RTP Protocol	*N/A*
	4.2 Recovery Timeline	• 24-48 Hours Relative Rest

		• Min. 24 Hours Per Stage • Other
	4.3 Medical Clearance	*N/A*
	4.4 High Performance Considerations	*N/A*
5. Follow-Up Care and Prognosis	**5.1** Persistent Symptoms	*N/A*
	5.2 Multidisciplinary Referral	*N/A*

Appendix VI: Traffic Light Table Grading Scale

To summarize the quality and completeness of SRC-related protocols, a scoring framework was applied across five categories:

1. Definition of SRC
2. Preventative Measures
3. Sideline Evaluation
4. Return-to-Play (RTP) Criteria
5. Follow-Up Care and Prognosis

Each category was assigned a score:

- **Yes** = +1 point (Green)
- **Other** = 0 points (Yellow)
- **No** = –1 point (Red)

The total score for each protocol could range from +5 (maximum) to –5 (minimum)**.** This overall score was used to assign a qualitative rating, mapped as follows:

Table 12

Traffic light scoring system

Score	Overall Rating	Colour
5	Excellent	Green
4	Good	Green
3	Fair	Yellow
2	Moderate	Yellow
1	Poor	Red
0	Very Poor	Red
-1 to -5	Worst	Red

Appendix VII: Summary of Included Study Characteristics

9.12 Included Study Characteristics

Table 13

Characteristics of included studies

Evidence Information (i.e. Year, Authors, Reference)	Type of Evidence (i.e. Publication Type, Source)	SRC Defined	Sport/ League	Preventative Measures	Sideline Evaluation	RTP	Follow-Up Care	Suggested Assessments
Silverberg et al., 2020 [71]	Journal article: *Archives of Physical Medicine and Rehabilitation* Guideline Synthesis	Yes	N/A	Education	Yes	Yes	Yes	SCAT5
Hubertus et al., 2019 [111]	Journal article: *Acta Neurochirurgica*	Yes	Football	No	Yes	Yes	N/A	SCAT, GCS, CS tests
Comeau & Pfeifer, 2019 [97]	Journal article: *Seminars in Pediatric Neurology*	Yes	N/A	EAP	Yes	N/A	N/A	GCS, SCAT5, BESS, mBESS, KD test, PCSS
McCrea & Guskiewicz, 2014 [79]	Guideline Summary: *Progress in Neurological Surgery*	Yes	N/A	EAP	Yes	Yes	Yes	SAC, SCAT5, and BESS
Cochrane et al., 2017 [104]	Journal article: *The Physician and Sports Medicine*	Yes	NHL, NBA, NFL, MLB	Education, Baseline	Yes	Yes	No	Varied
Lempke et al., 2020 [150]	Journal article: *Journal of Athletic Training*	No	N/A	No	No	Yes	No	SCAT5

Gunasekaran et al., 2020 [110]	Journal article: *The Physician and Sports Medicine*	-	AFL, ARU, BA, CAMS, CS, FFA, NRL, AJA, etc.	Education, Baseline	Yes	Yes	No	Varied
Herring et al., 2021[69]	Consensus Statement*: British Journal of Sports Medicine*	Yes	N/A	EAP, Equipment	Yes	Yes	Yes	SCAT5
McLarnon et al., 2022 [120]	Scoping Review: *International Journal of Environmental Research and Public Health*	Yes	DHI	No	Yes	Yes	No	RIDE-DHI, SCAT5
Cancelliere et al., 2024 [53]	Summary and Position Statement*: The Journal of the Canadian Chiropractic Association*	Yes	N/A	Education	Yes	Yes	Yes	SCAT6
Tarzi et al., 2020 [124]	Journal article: *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention*	Yes	FIFA	Policy	Not enforced	-	No	SCAT
Hamdan et al., 2022 [92]	Journal article: *Journal of Exercise Rehabilitation*	Yes	MMA, UFC	Equipment	Yes	Yes	No	SCAT5, KD
Elkington & Hughes, 2017 [105]	Position Statement: *Australian Institute of Sport*	Yes	N/A	Education	Yes	Yes	No	SCAT3
Prock et al., 2024 [84]	Journal article: *The Physician and Sports Medicine*	No	N/A	Education, Equipment, Policy	Yes	Yes	Yes	SCAT6/SCOAT6
Wicklund et al., 2018 [112]	Journal article: *Journal of Athletic Training*	Yes	Rodeo	Education	N/A	Yes	No	CISG RTP, SCAT
Pangrazio et al., 2024 [130]	Journal article: *Cureus*	Yes	Football	Education	N/A	No	No	SCAT6, GCS

Broglio et al., 2024 [54]	Organisation statement: *Journal of Athletic Training*	Yes	N/A	Education	Yes	Yes	Yes	Varied
Broglio et al., 2014 [80]	Position statement: *Journal of Athletic Training*	Yes	N/A	Education, Baseline	Yes	Yes	Yes	SCAT, BESS
Hohmann et al., 2024 [114]	Consensus statement: *Journal of Arthroscopic and Related Surgery*	No	N/A	Baseline	Yes	Yes	No	SCAT5/6, VOMS
Niederer et al., 2018 [160]	Journal article*: Brain Injury*	No	Rugby	Education	No	-	No	Varied
Whitehouse & Newcombe, 2023 [63]	Journal article: *British Journal of Hospital Medicine*	Yes	N/A	Education	Yes	Yes	Yes	ImPACT, SCAT5, GCS
Demetriades et al., 2024 [38]	Journal article: *Brain and Spine*	Yes	Football	Education, Baseline	Yes	Yes	No	Varied
Satarasinghe et al., 2019 [155]	Journal article: *Journal of Experimental Neuroscience*	No	N/A	No	No	Yes	No	-
Elliot et al., 2019 [156]	Journal article: *BMJ Open Sport & Exercise Medicine*	Yes	Road Cycling	No	Yes	No	No	SCAT5
Swart et al., 2021 [145]	Consensus statement: *Sports Medicine and Health Science*	No	Cycling	No	Yes	Yes	No	SCAT5, *2017 Berlin CISG statement*
Jacobi et al., 2023 [116]	Journal article: *The Musculoskeletal Journal of Hospital for Special Surgery*	No	NFL	Policy, Education, Equipment	Yes	Yes	No	SCAT, NFL Checklist, NFL RTP Protocol
Patricios et al., 2023 [131]	Assessment Tool: *Br J Sports Med*	No	N/A	-	No	Yes	Yes	SCOAT6
Patricios et al., 2023 [1]	Consensus statement: *Br J Sports Med*	Yes	N/A	Policy, Equipment, NMT	Yes	Yes	Yes	SCAT6, SCOAT6, CRT6
du Preez et al., 2022 [144]	Journal article: *Journal of Science and Medicine in Sport*	No	Combat	No	-	Yes	No	Varied
Davis et al., 2020 [95]	Guideline summary: *Neurosurgery*	No	N/A	Policy, Equipment, Education	Yes	Yes	Yes	SCAT
Frémont & Schneider, 2019 [157]	Recommendations: *Clin J Sport Med*	No	N/A	No	No	Yes	No	CRT5, SCAT5
Neidecker et al., 2019 [98]	Consensus statement: *Br J Sports Med*	Yes	Combat, MMA	Education, Baseline, Policy	Yes	Yes	No	-
Ellenbogen et al., 2018 [101]	Consensus statement: *Br J Sports Med*	Yes	NFL	Baseline, Education, EAP	Yes	Yes	No	NFL Checklists, NFL Locker Room Comprehensive

								Concussion Assessment, NFL Sideline Concussion Assessment
Nalepa et al., 2017 [161]	Journal article: *The Physician and Sports Medicine*	No	Combat, MMA	-	-	Yes	No	-
Abreu et al., 2016 [106]	Journal article: *The Sport Journal*	Yes	NFL	Technology, Equipment	Yes	Yes	No	SCAT, BESS
McCrory et al., 2017 [3]	Consensus statement: *Br J Sports Med*	Yes	N/A	Policy, Equipment, Baseline	Yes	Yes	Yes	SCAT5, SAC
Casey & Fonseca, 2019 [75]	Report of the Standing Committee on Health & Subcommittee on Sports-Related Concussions in Canada (Government Report)	Yes	N/A	Policy, Equipment, Education	Yes	Yes	Yes	SCAT5, CRT5, Medical Assessment Letter
England Football, 2023 [64]	England Football Concussion Guidelines	Yes	Football	Baseline	Yes	Yes	Yes	SCAT6, GRTP Programme, CRT6, SCOAT6
ECB, 2024 [55]	England Cricket Concussion Guidelines 2024	Yes	Cricket	Equipment, Baseline	Yes	Yes	Yes	CRT6, PSA, SCOAT6, IMPACT, SCAT6
NFL HNSC, 2022 [81]	NFL Head, Neck, and Spine Committee: Concussion Protocol	Yes	NFL	Education, EAP	Yes	Yes	-	NFL Sideline Concussion Assessment, SCAT5
AFL, 2022 [121]	Concussion Plan – AFL SRC Plan	Yes	AFL	Education, Policy	No	No	Yes	HeadCheck App
British Cycling, 2023 [65]	Concussion guidelines	Yes	BC	Equipment	Yes	Yes	Yes	CRT, Maddocks
FIBA, 2024 [85]	Concussion guidelines	Yes	FIBA	Baseline	Yes	Yes	No	CRT6, SCAT6, SCOAT6, ImPACT, Cognigram
FIFA, 2024 [56]	Concussion protocol	Yes	FIFA	EAP, Baseline	Yes	Yes	Yes	GCS, SCAT6
NHL, 2022 [109]	Concussion protocol	-	NHL	Education	Yes	Yes	No	SCAT5, VOMS, ImPACT
NBA, 2017 [133]	NBA Concussion policy	-	NBA	Education, baseline	No	Yes	No	SCAT5, NBA assessment tool,
NCAA, 2023 [66]	NCAA Concussion Protocol	Yes	N/A	Education, baseline	Yes	Yes	Yes	Varied

NICE, 2023 [141]	National Institute For Health And Care Excellence- Head Injury: Assessment And Early Management Guidelines	No	N/A	Training, Education	No	No	No	GCS
NRL, 2021 [93]	Guidelines: *NRL Participation, Game Development, and Community*	Yes	NRL	No	Yes	Yes	Yes	CRT5, SCAT5
ASC, 2024 [86]	Web source, statement summary*: Government of Australia*	Yes	N/A	Baseline	Yes	Yes	No	SCAT6, SCOAT6, CRT6
Rugby Australia, 2019 [126]	Rugby Australia Concussion Recommendations	Yes	Rugby	No	Yes	Yes	No	SCAT5, CRT5, HIA (if applicable)
Echemendia et al., 2023 [142]	SCAT6 SRC Assessment: *Br J Sports Med*	No	N/A	Baseline	Yes	No	No	SCAT6, mBESS, GCS
Elkington et al., 2019 [41]	Position Statement: *Australian Institute of Sport*	Yes	N/A	Education	Yes	Yes	No	CRT5, SCAT5
SMA, 2018 [78]	Concussion policy: *Sports Medicine Australia*	Yes	N/A	Education, Concussion Coordinator	Yes	Yes	Yes	CRT5
World Rugby, 2024 [115]	Concussion guide: World Rugby	Yes	Rugby	No	Yes	Yes	No	-
Parachute, 2024 [57]	Concussion Guidance: *Parachute*	Yes	N/A	Equipment, Rule Changes, Policy, NMT, Education	Yes	Yes	Yes	SCAT6, CRT6
The Danish Concussion Center, 2021 [146]	Concussion recommendation guide: *The Danish Concussion Center*	No	N/A	No	No	No	Yes	None
UK Government, 2021 [147]	Concussion publication: *UK Government*	Yes	N/A	Education, Technology	No	No	No	-
ACC, 2024 [58]	SRC Guideline: *ACC CIS Guideline*	Yes	N/A	Education, Recognition	Yes	Yes	Yes	None
Sport Singapore, 2019 [82]	SRC Guide: *Sport Singapore*	Yes	N/A	Education, Safe Practices	Yes	Yes	-	None
SRC South Africa, 2025 [51]	Web source: *SRC South Africa*	Yes	N/A	Education, Equipment, Rule Enforcement	Yes	Yes	Yes	Maddocks

CDC, 2025 [108]	Web source: *USA Government CDC*	Yes	N/A	Education, Rule Changes, Equipment	-	Yes	No	ACE
FiA, 2024 [135]	Concussion educational program: *FIA*	Yes	Motorsport	No	No	No	No	None
Motorsport Australia, 2020 [151]	Concussion management guidelines: *Confederation of Australian Motor Sport (Motorsport Australia)*	No	Motorsport	No	Yes	Yes	No	SCAT5, CRT5
CASC Ontario, 2021 [132]	Concussion protocol, *Canadian Automobile Sports Club: Ontario*	No	Motorsport	Equipment use, Baseline	-	Yes	No	SCAT5, CRT5
MNZ, 2022 [68]	Concussion guideline, *Motorcycling NZ*	Yes	Motorsport	Education, Equipment	Yes	Yes	Yes	ACC Concussion Card, Maddocks
Motorsport UK, 2024 [136]	Concussion policy, *Motorsport UK*	No	Motorsport	No	No	No	No	SCAT6
Baseball Canada, 2019 [99]	Concussion protocol, *Baseball Canada*	No	Baseball	Education	Yes	Yes	Yes	CRT5, SCAT5
Basketball Australia, 2024 [59]	Concussion guidelines, *Basketball Australia*	Yes	Basketball	Education, Baseline	Yes	Yes	Yes	CRT6, SCAT6, SCOAT6
Canada Basketball, 2019 [76]	Concussion policy, *Canada Basketball*	Yes	Basketball	Medical History	Yes	Yes	Yes	SCAT5
Basketball England, 2016 [107]	Concussion guidelines, *Basketball England*	Yes	Basketball	No	Yes	Yes	Yes	SCAT3
AIBA, 2020 [152]	Medical Handbook, *AIBA*	No	Boxing	No	Yes	No	No	SCAT3
Boxing Canada, 2020 [153]	Concussion protocol, *Boxing Canada & Institut National Du Sport Du Quebec*	No	Boxing	No	No	Yes	No	BCTT
ICC, 2024 [72]	Concussion guidelines, *ICC*	Yes	Cricket	Policy, Baseline	Yes	Yes	Yes	SCAT6
Cricket Australia, 2020 [125]	Concussion policy, *Cricket Australia*	No	Cricket	Equipment, Policy	Yes	Yes	No	SCAT5
UCI, 2024 [137]	Concussion information, *UCI*	No	Cycling	No	Yes	Yes	No	SCAT5
AusCycling, 2025 [83]	Web source: *AusCycling*	Yes	Cycling	Education	Yes	Yes	No	SCAT6, CRT6
Cycling Canada, 2020 [73]	Concussion protocol, *Cycling Cyclisme Canada*	Yes	Cycling	Baseline	Yes	Yes	Yes	SCAT5

Federation Equestre Internationale, 2023 [117]	Concussion policy, *Federation Equestre Internationale*	Yes	Equestrian Sports	No	Yes	Yes	No	CRT5, SCAT5
Equestrian Australia, 2021 [122]	Concussion information, *Equestrian Australia*	Yes	Equestrian Sports	No	Yes	Yes	No	SCAT5, CRT5
Equestrian Canada, 2020 [74]	Concussion policy, *Equestrian Canada Equestre*	Yes	Equestrian Sports	Education, Clinical History, Equipment	Yes	Yes	Yes	SCAT5
Equestrian Sports New Zealand, 2024 [87]	Concussion policy: *Equestrian Sports New Zealand*	Yes	Equestrian Sports	No	Yes	Yes	Yes	SCAT6, CRT6, BIST, ACC SportSmart Concussion Card
Medical Equestrian Association Ireland, 2016 [129]	Concussion summary, *Horse Sport Ireland*	Yes	Equestrian Sports	No	Yes	Yes	No	Maddocks
British Equestrian, 2023 [90]	Concussion guidelines, *British Equestrian Federation*	Yes	Equestrian Sports	No	Yes	Yes	Yes	CRT5, SCAT5
US Equestrian, 2025 [113]	Concussion web source and resources, *United States Equestrian Federation*	No	Equestrian Sports	Education	Yes	Yes	No	CRT6, SCAT6, ImPACT
Hockey Australia, 2024 [60]	Concussion policy, *Hockey Australia*	Yes	Field Hockey	Equipment	Yes	Yes	Yes	SCAT6
Field Hockey Canada, 2021 [94]	Concussion protocol/policy, *Field Hockey Canada* (web source)	Yes	Field Hockey	Education	Yes	Yes	No	CRT5, SCAT5
GB & England Hockey, 2020 [96]	Concussion policy, *England Hockey*	Yes	Field Hockey	No	Yes	Yes	Yes	SCAT5, Pocket CRT
Football Australia, 2019 [127]	Concussion policy, *Football Federation Australia*	Yes	Football	No	Yes	Yes	No	SCAT5
Canada Soccer, 2018 [102]	Concussion policy, *Canada Soccer Sports Medicine Committee*	Yes	Football	No	Yes	Yes	Yes	CRT5
Meyer et al., 2023 [118]	Concussion protocol, *DFL Deutsche Fußball Liga*	No	Football	Baseline, Education	Yes	Yes	No	SCAT5
NZF, 2018 [128]	Concussion policy, *New Zealand Football*	Yes	Football	No	Yes	Yes	No	SCAT5, Pocket CRT, ACC SportSmart Concussion Card

Broglio et al., 2019 [77]	Concussion guidelines, *USA Soccer*	Yes	Football	Policy, Baseline, Equipment, Neck Strength	Yes	Yes	Yes	SAC, mBESS, SCAT5
IIHF, 2021 [148]	Concussion protocol, *IIHF*	No	Ice Hockey	No	Yes	Yes	No	None
NZIHF, 2024 [138]	Concussion policy, *New Zealand Ice Hockey Federation*	No	Ice Hockey	No	Yes	Yes	No	CRT6
Stuart et al., 2019 [158]	Concussion protocol, *USA Hockey*	No	Ice Hockey	No	Yes	Yes	No	CRT5
Banks & Eyres, 2023 [91]	Concussion protocol, *British Judo*	Yes	Judo	Education	Yes	Yes	No	CRT5, SCAT5
Karate Australia, 2024 [88]	Concussion policy, *Karate Australia*	Yes	Karate	No	Yes	Yes	Yes	None
WAKO, 2021 [149]	Medical guidelines, *World Association of Kickboxing Organisations*	No	Kickboxing	No	No	No	No	None
Kickboxing GB, 2025 [134]	Web source, *Kickboxing Great Britain*	No	Kickboxing	No	Yes	Yes	No	None
World Lacrosse, 2020 [154]	Concussion policy, *World Lacrosse*	Yes	Lacrosse	No	No	No	No	SCAT5, Pocket CRT
Lacrosse Canada, 2024 [61]	Concussion guidelines, *Lacrosse Canada*	Yes	Lacrosse	Education, Equipment	Yes	Yes	Yes	SCAT6, Child SCAT6, CRT6
NZ Lacrosse, 2024 [139]	Concussion policy, *New Zealand Lacrosse*	No	Lacrosse	No	No	Yes	No	Pocket CRT
Echemendia & Hong, 2023 [119]	Concussion guidelines, *USA Lacrosse*	Yes	Lacrosse	EAP	No	Yes	No	SCAT5
Canada Rugby League, 2019 [100]	Concussion policy, *Canada Rugby League*	Yes	Rugby	Education	Yes	Yes	No	SCAT2, Pocket SCAT
SARU, 2024 [62]	Web source, *South Africa Rugby*	Yes	Rugby	Education, Policy, Equipment, Techniques	Yes	Yes	Yes	SCOAT6, SCAT6, CRT6
HEADCASE, 2023 [67]	Concussion program, *Rugby Football Union*	Yes	Rugby	Equipment, Education, Exercise/Techniques,	Yes	Yes	Yes	SCAT6, SCOAT6, CRT6
Softball Canada, 2025 [52]	Concussion protocol, *Softball Canada*	Yes	Softball	Education	Yes	Yes	Yes	SCAT5

World Taekwondo, 2019 [159]	Medical code: concussion guidance, *World Taekwondo*	No	Taekwondo	Rules	Yes	No	No	SCAT5
Taekwondo Canada, 2021 [70]	Concussion protocol, *Taekwondo Canada*	Yes	Taekwondo	Policy, Equipment, Education	Yes	Yes	Yes	CRT5, SCAT5
FIVB, 2024 [140]	Concussion protocol, *The International Volleyball Federation*	No	Volleyball	No	No	Yes	No	SCAT5
Volleyball Canada, 2024 [89]	Concussion protocol, *Volleyball Canada*	No	Volleyball	Education	Yes	Yes	Yes	SCAT6, CRT6
Wrestling Canada Lutte, 2018 [103]	Concussion protocol, *Wrestling Canada Lutte*	No	Wrestling	Education	Yes	Yes	Yes	SCAT5, CRT5
Falahati, 2021 [123]	Concussion guidance, *British Wrestling*	Yes	Wrestling	No	Yes	Yes	No	None
USA Wrestling, 2023 [143]	Concussion guidance, *USA Wrestling*	No	Wrestling	No	Yes	No	No	None

Appendix VIII: Excluded Study Characteristics

9.13 Excluded Studies

9.13.1 Database Evidence Exclusion

During the screening process, reports were excluded based on predefined eligibility criteria. From the database search, exclusions were made for reports that did not address SRC guidelines or policies (n = 39), were not relevant to the scope of the review (n = 25), involved the wrong population (n = 19), or were not directed at medical professionals (n = 6).

9.13.2 Manual Search Exclusion

Additionally, in the manual selection process, reports were excluded for being background articles (n = 9), not directed at medical professionals (n = 6), or involving the wrong population (n = 2). These exclusions ensured that the included evidence aligned with the review's objectives and focus on current SRC guidelines and their application in high-performance sports setting.

Following the cross-reference search, listed evidence (n=86) was compared across the eligibility criteria, and evidence from the initial search (i.e. PRISMA protocol and manual search). Evidence was manually de-duplicated and excluded if already included through the previous search methods (n=10). Further exclusions were made for evidence that were not directed at medical professional (n=5), were inaccessible (n=5), not available in English (n=3), or were not relevant to the scope of the review (n=3).

In total, from the manual searches, exclusions were made for reports that were not relevant to the scope of the review (n=3), were background articles (n=9), involved the wrong population (n=2), were inaccessible (n=5), not available in English (n=3) or were not directed at medical professionals (n=11). This equates to 120 pieces of excluded evidence from manual and database searches (n=120).

Appendix IX: Full Evidence Information

9.14 Data Extraction Instrument

Table 14

Summarised evidence characteristics using a tabulation method

Evidence Information (i.e. Year, Authors, Reference)	SRC Definition	Prevention Guidelines	Event of Injury	Injury Timeline (i.e. Aftercare, Treatment, Timeline)	Additional Information (i.e. Relevant information, Type of Evidence)
Silverberg et al., 2020 [71]	A condition caused by biomechanical forces sufficient to disrupt brain function, without requiring a direct blow to the head. Mechanisms include blunt force trauma, acceleration-deceleration (e.g., whiplash), or blast forces. Often, TBI's are mild, meaning LOC is less than 30 minutes, and PTA is less than 24 hours following the event. Diagnosis is primarily clinical, relying on evidence of AMS immediately following the event. AMS manifestations include LOC, confusion, or memory gaps. Symptoms must align with a plausible MOI.	Does not include preventive strategies within its discussion of mTBI management, but stakeholder education is discussed as a management strategy.	**(1) Establish MOI** • If plausible MOI is identified with worsening symptoms (physical/cognitive), mTBI should be presumed, and PA must be restricted until symptoms resolve (and/or if diagnosis is confirmed). **(2) Evaluate AMS:** • Assess for post-injury AMS, including LOC, memory gaps, confusion, etc. Symptoms may evolve over minutes. Interviews guide clinicians in understanding patient mental status post-injury. **(3) Identify Confounding Factors:** • Rule out alcohol, psychological stress, or physiological issues (e.g., hypoglycaemia) as alternative causes of AMS. Interviews provide context for excluding non-mTBI factors. **(4) Integrate Evidence for Diagnosis:** • Combine all data to conclude mTBI diagnosis, considering evidence against misdiagnosis.	**Immediate Post-Injury Management:** • Emphasizes that RTP decisions should be conservative and prioritise caution. **Gradual RTP:** • Relative rest for 24–48 hours, followed by gradual reintroduction of activities if symptoms do not worsen. Avoid total rest; instead, progressively increase ADL and environmental stimulation. • Patients should not RTP to high-risk environments (e.g., collision sports) until clinically recovered. Incremental progression with 24-hour minimum phases including gradual increases in intensity/ demands, guided by clinicians. • Full recovery determined by symptom resolution: the ability to tolerate ADLs and stimuli (e.g., high-intensity movement, light, noise), and normalized findings on clinical tests. Clinicians should guide the process throughout. **Prolonged Symptoms:** • If recovery takes longer than 1–2 weeks (in adults), symptom management is needed. Persistent symptoms should be clinically evaluated. Focus on interventions that offer the greatest symptom relief. Provide necessary accommodations (e.g., academic or behavioural adjustments, light exercise) to support gradual recovery.	• Type of Evidence – ACRM Guideline Synthesis: *Archives of Physical Medicine and Rehabilitation*
Hubertus et al., 2019 [111]	SRC defined through *2017 Berlin CISG statement:* A complex functional disturbance in the brain caused by direct/indirect forces to the head, face, neck, or body. The condition primarily involves transient symptoms like headache, confusion, memory issues, or dizziness. These symptoms	Briefly acknowledges the necessity for protective measures but does not provide additional details or elaboration on the topic.	**Diagnosis** • Immediate Removal: As per 2016 FIFA and CISG guidelines, players must be removed from play and assessed for SRC symptoms using standardized tools. • If SRC is not definitively ruled out, the athlete should remain off the field for further evaluation. **Sideline Evaluation**	**Immediate Post-Injury Management:** • **Rest**: After removal from play and medical clearance, the athlete should rest for 24-48 hours, avoiding stimuli (e.g., bright light, loud noise) and strenuous activities while symptomatic. **Gradual Return to Activities:** • **Gradual RTP**: PA levels should be progressively increased without worsening symptoms, with 24-hour intervals between each phase. Training should	• Type of Evidence - Journal article: *Acta Neurochirurgica* • SCAT5 is recommended as an effective sideline evaluation tool; baseline SCAT5 should be conducted pre-season for increased reliability (including red flags, symptom observation, memory, GCS, and CS assessment).

	usually resolve within a couple of weeks. SRC does not cause detectable structural damage on standard brain imaging (e.g., CT or MRI).		• Evaluation should include consciousness/LOC, orientation, cranial nerve function, and severe injury indicators. • Red Flags: Vomiting, sensory deficits, seizures, or signs of structural brain/spinal injury require urgent medical attention and further diagnostic testing by specialists.	continue incrementally until full performance is restored. • **Graded RTS Phases**: Includes initial rest, symptom-limited PA, light aerobic exercise, sport-specific exercises, non-contact training, full-contact training, and full RTS. • **Sport Absence**: Sufficient absence from sport is recommended to prevent complications like PCS or SIS.	• Prevention, management, and prognosis strategies primarily adapted from *2017 Berlin CISG statement* guidelines. • Lack of FIFA protocol awareness and implementation due to game restrictions. • **Future Diagnostics**: Emphasis on advanced imaging and neurochemical biomarkers.
Comeau & Pfeifer, 2019 [97]	SRC is equated to a change in brain function following biomechanical forces to the head, neck, or body. This event may be followed with LOC and symptoms such as neurological and cognitive disfunctions.	Venue specific EAP's should be developed, with specific attention given the arrival and extraction processes of EMS.	• Conduct a thorough assessment for life-threatening injuries, prioritising cardiac, neurological, and cervical spine care. Patients with LOC should be treated as having a cervical spine injury. Use GCS to assess responsiveness. Observe for altered LOC, deformities, vomiting, and other 'red flags.' **Secondary Sideline Evaluation** • The goal is to identify suspected SRC, not to rule them out. The patient should be removed from play and not return until fully cleared. Conduct assessments in a quiet, distraction-free environment. • Use PCSS and SAC (from SCAT5) to track evolving symptoms (somatic, cognitive, emotional, sleep). Include motor control assessments. Incorporate the KD test for visual complaints and assess reaction time. Additional testing should include reaction time assessment.	• Urgent symptoms like neck pain, vomiting, LOC, and convulsions should be closely observed, and the patient should not be left alone immediately after injury.	• Type of Evidence - Journal article: *Seminars in Pediatric Neurology* • Technology Assistance**:** Video recordings or helmet impact sensors can support SRC diagnosis. • Use GCS, SCAT5, BESS, mBESS, KD test, PCSS, and Maddocks questions for effective symptom assessment. • The NFL's Madden Rule allows formal evaluation without disadvantage to players or teams, encouraging injury identification. Similar policies are seen in WR and NCAA soccer guidelines. • **"**When in doubt, sit them out**":** The general rule for SRC management to prevent further injury.
McCrea & Guskiewicz, 2014 [79]	SRC is a brain injury caused by biomechanical forces directly to the head or elsewhere on the body, resulting in a transient disturbance of brain function. Concussions typically cause a rapid onset of short-lived neurological impairments, which generally resolve within a brief period. Diagnosis is primarily clinical (i.e. based on the MOI, range of symptoms, and expertise from healthcare providers) and is crucial for accurate identification.	EAP should clearly indicate protocol for management of injuries including SRC.	**Immediate Management** • **Removal from Play**: Athletes suspected of SRC must be immediately removed from play and prohibited from returning on the same day. Immediate focus on ruling out critical injuries (e.g., cervical spine, brain trauma, airway obstruction) that require urgent medical attention. • Symptoms span physical (e.g., headache, nausea), cognitive (e.g., forgetfulness), emotional (e.g., irritability), and sleep-related issues. Diagnosis requires linking these symptoms to a plausible mechanism of injury (MOI). • Use tools like symptom checklists (e.g. SAC, SCAT5, and BESS) to evaluate status objectively. Balance assessment (e.g., BESS testing) is critical.	**Recovery Timeline** • Symptom relief typically occurs within 1-3 days post-injury, supported by clinical follow-ups using standardized assessments to monitor progress. • Performance-based measures should be introduced as symptoms resolve or near resolution. **Graduated Return-to-Play (RTP)** • RTP should not occur while experiencing SRC symptoms. • An initial rest period (24–48 hours) is crucial, encompassing both cognitive and physical rest. A gradual RTP protocol is recommended, progressively increasing PA levels. • The CISG RTP protocol involves 24-hour stages per level, advancing only if symptoms do not recur. If symptoms reappear, the patient should revert to the	• Type of Evidence - Guideline Summary: *Progress in Neurological Surgery* • Evaluation, management, and diagnosis understandings summarized from AAN, NATA, AMSSM, and CISG recommendations.

			Neuropsychological testing can support diagnosis but is not mandatory. No single test suffices due to the heterogeneous nature of SRC.	previous stage. Protocols can be tailored to individual needs.	
Cochrane et al., 2017 [104]	Adopted by the NFL, NBA, NHL, and MLB, the definition of concussion aligns with the *2012 CISG Consensus Statement:* SRC is described as a complex pathophysiological process affecting the brain, caused by biomechanical forces. Diagnosis does not require LOC, and symptoms can vary.	All organisations provide preseason education on SRC reporting, recognising signs/symptoms, and basic management strategies. Each league mandates baseline evaluations during preseason for accurate future assessments. **Major Variation**: No universal educational materials are standardized across organisations.	**Sideline Evaluation** • All leagues recommend SCAT for sideline assessment. • NBA and NHL evaluate suspected SRC in a separate, quiet environment. NBA, MLB, and NHL require immediate removal from play if SRC is suspected. **Positive Diagnosis** • **NFL**: Serial assessments required; players removed from play and provided with take-home instructions. Same-day RTP is prohibited. • **NBA**: RTP restricted on the same and following day; athletes must limit physical/mental stimuli while symptomatic. RTP protocol starts after 24 hours symptom-free, with no fixed minimum timeline. • **MLB**: Additional testing determines placement on the disability list. RTP permitted after a 7-day minimum. • **NHL**: Athletes removed from play until symptom-free at rest, followed by a tailored RTP protocol. Same-day RTP is prohibited.	**Return to Play** • **NFL:** player must (1) return to baseline values on all assessments and examinations (2) successfully complete individualized RTP protocol (3) evaluated by an independent consultant and (4) be cleared by team physician and meet baseline criteria • **NBA:** must be symptom free, obtain medical clearance, and successfully complete a graded RTP protocol to return. If symptoms recur at any step, they must return to previous stage of protocol. • **MLB:** player must return to baseline scores on assessments and ImPACT test, remain symptom free at rest and with exertion, and be cleared by physician following evaluations. • **NHL:** player must be medically cleared, be symptom free both at rest and during exertion, and be within baseline scores on relevant assessments.	• Type of Evidence - Journal article: *The Physician and Sports Medicine* • Policies for SRC management across the NHL, NBA, NFL, and MLB have been summarized and compared based on publicly available information. **Commonalities Across Leagues** (i.e. that all leagues require): • Cognitive assessments. • Immediate removal from play when SRC is suspected. • A stepwise RTP protocol. • Medical clearance before returning to play. **Compliance Challenges**: • Variations in rules, pacing, and equipment (e.g., uniforms) across sports may contribute to difficulties in implementing standardized consensus recommendations effectively.
Lempke et al., 2020 [150]	No definition of SRC provided.	Does not address or include preventive strategies within its discussion of SRC management.	**Diagnosis** • ATs primarily use clinical examinations, symptom assessment tools, and balance assessments to diagnose SRC. • Tools like the SCAT5 and computerized neurocognitive tests were among the most utilized, though adoption rates varied by work setting and education level. • Majority of ATs believe in the necessity of training for both traditional and computerized neurocognitive assessments.	**Management** • Published RTP guidelines were the most used tools for managing SRC recovery, alongside up-to-date clinical exams. • Key stakeholders in RTP decisions included team physicians, ATs, and primary care physicians. • RTP progression followed evidence-based guidelines, emphasizing symptom resolution and gradual reintegration into activities.	• Type of Evidence - Journal article: *Journal of Athletic Training* • Presented from the perspective of ATs affiliated with NATA. • Despite improvements, the continued use of outdated practices (e.g., SCAT2, concussion-severity grading scales) was noted, emphasizing the need for consistent updates to practice standards and discontinuation of outdated tools.
Gunasekaran et al., 2020 [110]	AFL, ARU, NRL, and FFA rely on the 5th ICCC definition: A complex pathophysiological process affecting the brain, caused by biomechanical forces. Other sporting codes provided varying	Educational resources are inconsistently provided, with the AFL offering videos but no compulsory programs. Baseline testing with inclusion of tools (e.g.	**Diagnosis and Sideline Treatment** • Sideline assessments using standardized tools (e.g., SCAT-5, CRT5) are common in many codes, particularly AFL and NRL. • Removal from play is mandated upon suspected SRC, with assessments conducted by medical personnel,	**Management Protocols** • *Most* codes implement a stepwise RTP protocol, where each stage requires the athlete to remain symptom-free for 24 hours before progressing. • Mandatory rest periods vary: ARU requires a minimum of 7 days for adults and 14 days for minors,	• Type of Evidence - Journal article: *The Physician and Sports Medicine* • Summarizing guidelines from AFL, ARU, BA, Baseball Australia, CAMS, CA, FFA, Hockey Australia, NRL, Netball Australia,

	levels of detail, with some failing to define concussion at all. Other sporting organisations had no concussion definition (e.g., CAMS, AJA, etc.)	SCAT-5 and CogSport) is encouraged but not mandated for most sporting codes.	sometimes supported by real-time video reviews. • Some sports employ independent MDD for sideline assessments and video analysis.	while AFL mandates a minimum of 24 hours per stage but does not set a total rest period. • Clearance by a certified SRC practitioner is required across all professional football codes before RTP.	AJA, Tennis Australia, and Volleyball Australia. • There is a lack of consistent SRC protocols across Australian sporting codes, with some offering no public guidelines at all. • The use of standardized tools like SCAT-5 is prevalent, but implementation varies between sports. • Highlights the need for a unified national approach to SRC management in Australian sports to enhance player safety and streamline best practices.
Herring et al., 2021 [69]	SRC is a TBI stemming from direct or indirect biomechanical forces, related to linear and/or rotational accelerations to the brain (i.e. impact to head or body). It involves rapid-onset neurological impairments, typically resolving spontaneously, without structural damage evident on neuroimaging. Symptoms often include cognitive, somatic, and emotional disruptions, and SRC diagnosis is a clinical decision based on MOI and symptom presentation.	**Preventative Measures:** Development of EAP and education recognising SRC symptoms and risks. Proper fitting of helmets and protective gear to reduce risk. Safe sport techniques (e.g., proper tackling, avoiding head-first impact) and enforcing rules to penalize unsafe behaviour.	**Sideline Treatment:** • Observing immediate signs such as LOC, confusion, or uncoordinated movements. Assessment tools like SCAT5 used for evaluation. • **Initial Management:** Immediate removal from play if SRC is suspected. Athletes are evaluated in a distraction-free environment for cognitive, somatic, and emotional symptoms. • **Emergency Red Flags:** Indicators like headache, persistent vomiting, and neurological deficits necessitate urgent medical attention. • **Post-Injury Protocol:** Continuous monitoring, home observation, and provision of post-event care instructions. Decisions are based on clinical judgment, ensuring no same-day RTP for suspected SRC.	**RTP and Management Protocols:** • **Graduated RTP:** A stepwise approach is used, starting from rest and progressing through increasing physical and cognitive activity levels. Each step requires symptom-free completion before advancing. • **Management Strategies:** Early aerobic exercise promotes recovery, while prolonged rest is discouraged as it may delay recovery. Athletes must meet baseline criteria and receive medical clearance before RTP. • **Persistent Symptoms:** Individualized treatment plans involving multidisciplinary care, including vestibular rehabilitation, cognitive therapy, and symptom-specific management. • **Follow-up/PSaSRC:** Requires a multidisciplinary team to focus on symptom resolution strategies.	• Type of Evidence - Consensus statement developed by TPCC, led by ACSM (*British Journal of Sports Medicine)* • Diagnosis and management decisions rely on the expertise of MPs, with a focus on symptom resolution and athlete safety.
McLarnon et al., 2022 [120]	A TBI resulting from biomechanical forces, characterized by a rapid onset of transient impairment. SRC does not necessarily involve a LOC and can result from both direct impacts and/or indirect forces transmitted to the head during DHI.	No inclusion of established preventative measures but suggests future directions including track modifications, updated sport-specific guidelines, helmet technology, and educational programs.	**Sideline Treatment** • **RIDE-DHI Protocol**: A proposed three-stage assessment framework for SRC: 1. **RIDE-DHI 1**: Immediate sideline assessment to identify key symptoms (e.g., convulsion, confusion, ataxia). Includes video reviews and standardized symptom checklists. 2. **RIDE-DHI 2**: A detailed post-event evaluation in a quiet medical room (i.e. removal from course) using tools like SCAT-5 and neurocognitive assessments.	**Management Protocols** • **Graduated RTP Stages**: Adapted from SCAT-5 and *2017 Berlin CISG statement* with a minimum 24-hour period between stages, with monitoring for symptom recurrence. RTP delays beyond four weeks require further investigation. • Removal of play is not required unless additional analysis (e.g. RIDE-DHI2) is required. Competitor may RTP the same day as injury event if passing first assessment.	• Type of Evidence - Scoping Review: *International Journal of Environmental Research and Public Health* • Lack of tailored sideline assessments and unified policies for DHI. Recommendations for a sport-specific consensus meeting to create enforceable guidelines.

			3. **RIDE-DHI 3**: An assessment the next day to identify delayed symptoms, involving repeated SCAT-5 and neurological evaluations. • **SCAT-5 Usage**: Recognised as effective but noted to have practical limitations in high-speed sports like DHI.		
Cancelliere et al., 2024 [53]	Definition adopted by CCGI, CCA, AND RCCSSC, using definition given by WHO Collaborating Center Task Force: mTBI are acute brain injuries caused by mechanical forces to the head/body. Diagnosis relies on clinical criteria, including symptoms such as confusion, disorientation, amnesia, headaches, or dizziness. Red flags for severe injuries necessitate immediate referral.	Education for stakeholders.	**Sideline Treatment** • Emphasis is placed on removing athletes with suspected SRC from play to prevent exacerbation and ensuring a thorough evaluation before returning to PA. • SCAT6 recommendations used for all portions of assessment (e.g. observation, red flags, history, examination), management (e.g. RTP), and prognosis.	**Management Protocols:** • Graduated RTS approach: tailored to symptom severity and patient tolerance. Key strategies include initial rest followed by controlled PA reintroduction. • Symptom monitoring and incremental RTS protocols under professional supervision.	• Summary and position statement: *The Journal of the Canadian Chiropractic Association* • Chiropractors and other healthcare professionals are vital for managing SRC effectively.
Tarzi et al., 2020 [124]	Adopted ICCS SRC definition: A complex pathophysiological brain injury caused by biomechanical forces.	Policy changes (i.e. temporary substitution rules) meant to emphasise player health.	**Sideline Treatment** • Assessments for PCEs: often insufficient and lacked thoroughness. Recommended assessments (e.g. SCAT) were underutilized due to time constraints and cultural pressures. • Observations such as LOC should prompt immediate evaluation but were not consistently addressed. • Many players RTP prematurely without adequate assessment.	**RTP:** • Players showing signs of SRC must not RTP without a thorough professional assessment. • Most PCEs resulted in players RTP without sufficient evaluation.	• Type of Evidence - Journal article: *Injury Prevention: Journal of the International Society for Child and Adolescent Injury Prevention* • **PCE:** any incident during play that involves head trauma or biomechanical forces transmitted to the head, resulting in observable signs indicative of possible SRC (e.g. LOC, disorientation, slow recovery from impact, or other neurological impairments). • Despite FIFA's endorsement of SRC protocols, adherence remains low.
Hamdan et al., 2022 [92]	SRC in MMA are categorized as mTBI caused by biomechanical forces, either from direct blows to the head or indirect forces transmitted to the head. Characterized by rapid onset of neurological dysfunction, typically resolving spontaneously.	Equipment: mandatory mouthguards for athletes and regulations against certain dangerous manoeuvres, such as head-butting and strikes to the back of the head. Protective gear (e.g. headgear) is suggested but not enforced.	**Diagnosis and Sideline Treatment**: • Neurocognitive and behavioural testing tools (SCAT5 and KD) are recommended for initial evaluation. • Advanced imaging techniques, like DTI and fMRI may improve diagnostic accuracy.	**RTP and Management Protocols**: • Athletes must be symptom-free and medically cleared before returning to contact training and sparring. • UFC protocol: includes progressive stages of recovery with daily symptom checks and physical therapy.	• Type of Evidence - Journal article: *Journal of Exercise Rehabilitation*

Elkington & Hughes, 2017 **(105)**	A brain injury caused by a force to the head or body, transmitting energy to the brain. It results in brief neurological impairments that typically resolve without medical intervention but require a cautious and structured management approach.	Briefly acknowledges the necessity for education on SRC recognition.	**Diagnosis and Sideline Treatment**: • SCAT3 tool is recommended alongside clinical judgment for diagnosing SRC. • **Time of Event:** Athletes suspected of SRC should be removed immediately and not allowed to return on the same day. • Medical assessments include symptom evaluation, cognitive testing, and balance assessments. First aid emergency medicine is essential.	**Management Protocols**: • Immediate management should include cognitive and physical rest. Gradual RTP protocols require symptom-free progression with a minimum of 24 hours at each activity level. • Must be symptom-free and cleared by a medical professional before resuming RTP. • Athletes should undergo regular follow-ups to ensure symptom resolution and identify any lingering issues.	• Type of Evidence - Position Statement: *Australian Institute of Sport*
Prock et al., 2024 **(84)**	No definition of SRC provided.	Most organisations conduct educational campaigns on SRC. Attempts at rule changes are sport specific (e.g. NHL penalizes dangerous hits). Protective equipment is encouraged across all.	**Sideline Care** • Sideline assessment often involves standardized methods (e.g. SCAT5/6). • All organisations agree on immediate removal from play upon suspicion of SRC; however, implementation varies (i.e. WR uses HIA, FIFA is inconsistent) • Diagnosis requires observation of cognitive and physical symptoms, alongside a thorough evaluation of MOI and patient history.	**Management Strategies** • As per SCAT6: Initial management includes mandatory physical and cognitive rest, with RTP steps beginning in first 24 hours. A period of relative rest (24-48 hours) is consistent with CISG but is defined differently across organisations. • All organisations recommend a RTP approach, but the specific stages and timelines differ (i.e. WR has 7-day minimum, where FIFA has no minimum). Necessary focus on avoiding premature return, which increases the risk of complications like prolonged symptoms or SIS. **Follow-Up Care** • Involves periodic reassessment of symptoms, cognitive function, and physical capabilities, but differs significantly across organisations (e.g. no structured guidelines)	• Type of Evidence - Journal article: *The Physician and Sports Medicine* • Despite shared reliance on CISG guidelines, enforcement and adherence vary significantly • Emphasis on individualized protocols, sport-specific considerations, and updates reflecting the latest research findings.
Wicklund et al., 2018 **(112)**	A complex pathophysiological brain process caused by biomechanical forces, such as a blow to the head/body. It disrupts normal brain function, with symptoms typically decreasing in intensity and frequency over the first month post-injury.	Emphasis on educational information surrounding SRC.	• Rodeo athletes suspected of a SRC must be removed from competition immediately. • Nature of sport restricts sideline analysis but assessments (e.g. SCAT5) are recommended to assess symptoms.	**Management Strategies:** • **Initial Rest**: A symptom-limited activity period (i.e. relative rest) of 24–48 hours is recommended. • Graduated RTP plan adopted from *2017 Berlin CISG statement*. Suggests that this protocol should be modified to fit the nature of rodeo. • Clearance is mandatory before advancing stages, with certified athletic trainers playing a key role in follow-up evaluations.	• Type of Evidence - Journal article: *Journal of Athletic Training* • Rodeo often requires self-directed RTP stages due to travel demands. • Highlights need for standardized communication and medical supervision.
Pangrazio et al., 2024 **(130)**	Concussions are TBIs caused by external forces (i.e. blows to the head or body) which disrupt neurological function. While immediate symptoms (e.g. disorientation, memory loss, impaired motor skills) are often detectable, some concussions present subtle signs, making accurate diagnosis challenging.	Education and training for accurate and immediate recognition of SRC. Emphasis on strict adherence to safety protocols: to discourage unsafe practices.	**Sideline Care:** • Current practices include on-field assessment, sideline evaluation, and off-field medical exams. Medical staff assess signs of SRC through observation of symptoms and use of tools (e.g. SCAT6) and other standardized assessments are used to evaluate cognitive function and balance (e.g. Maddocks, GCS).	• Players with suspected SRC are *typically* removed from play for further evaluation. • Players undergo cognitive and neurological assessments to determine the severity of the injury.	• Type of Evidence - Journal article: *Cureus* • A proposed algorithm incorporates GCS, orientation questions, and modified SAC to guide decisions on medical care and RTP evaluations.

Broglio et al., 2024 [54]	Includes reference to Broglio et al., 2014 for SRC definition (80).	Education *specific* for ATs emphasized (i.e. proper terminology, prevention, recognition, equipment knowledge). Baseline assessments are necessary for proper evaluation of SRC.	**Sideline Evaluation**: • Athletes suspected of SRC must be removed from play immediately and evaluated systematically. • Recommended tools include SCAT, SAC, and BESS tests for assessing symptoms (e.g. motor control, mental status) and potential diagnosis. • Observation of "red flags" (e.g. vomiting, seizures, unequal pupil size) may require emergency transport.	**Initial Management**: • Complete removal from play and a period of physical and cognitive rest during the acute phase of recovery. • **RTP Approach**: A stepwise protocol with a minimum 24-hour progression between stages (i.e. from no PA to full RTP). Athletes should only return when symptom-free and meeting pre-injury baseline scores on all assessments. **Follow-up:** • Comprehensive SRC management plan should include portion of home care that involves other stakeholders. This plan should include daily monitoring of symptoms and avoidance of strenuous activities to prevent symptom exacerbation.	• Type of Evidence – Organisational Statement and Guideline: *Journal of Athletic Training* **Biggest Changes from 2014:** • Updated 2024 statement incorporates a biopsychosocial framework for management, emphasizing biological, psychological, and social factors influencing recovery. • Introduces mental health assessment and management: recognising the impact of preexisting and post-concussion psychological conditions.
Broglio et al., 2014 [80]	A trauma-induced alteration in mental status. It involves rapid acceleration/deceleration of the brain, leading to neuronal shearing and changes in ionic balance and metabolism, typically resulting in a temporary disruption of brain function.	Emphasizes baseline testing and *general* education as integral for high-risk athletes and younger populations.	**Diagnosis Information** • Immediate removal from play, with a systematic evaluation conducted. No athlete should return to play the same day. • Key assessments include observing mental status changes, balance (e.g., BESS test), and using standardized tools (e.g. SAC and SCAT).	**Management Strategies** • Rest is critical during the acute phase (physical and cognitive rest) to avoid symptom exacerbation. • Daily monitoring of symptom resolution and return to baseline levels on clinical, cognitive, and motor tests before starting RTP protocols (no specific steps mentioned). **Follow-Up Care** • Follow-up includes ensuring symptoms have resolved and baseline testing is back to normal.	• Type of Evidence – Position statement: *Journal of Athletic Training*
Hohmann et al., 2024 [114]	No definition given.	Panel determined baseline assessments as it is useful for later comparison.	• Tools such as SCAT 5/6 recognised as reliable immediate on-field assessment. Must be subsequently paired with SCAT off field assessment, and other standardized tests (e.g. VOMS tool).	**RTP Protocols:** • A graduated, individualized RTP protocol is recommended as per *2017 Berlin CISG statement*. Including a minimum rest period of 24-48 hours post-injury. • Progression involves symptom-limited PA advancing to full return only after symptom resolution. During this, continuous monitoring done to ensure no symptom recurrence; step back if symptoms reappear.	• Type of Evidence – Consensus statement: *Journal of Arthroscopic and Related Surgery* • No explicit preventative or diagnostic strategies were discussed beyond using validated tools and assessments to reduce risks of premature RTP.
Niederer et al., 2018 [160]	No definition given.	Education for team staff and players on recognising symptoms and the dangers of premature RTP (i.e. diagnostic equipment).	• Appropriate tools (e.g. SCAT and/or GCS) should be done for first sideline diagnosis.	**RTP Protocols:** • Adherence to RTP guidelines, including 1–2 day period of complete cognitive and physical rest, followed by gradual increase in activity under sub-symptom thresholds, is recommended but not universally implemented (e.g. 5R protocol). • RTP process completion when the player is symptom-free and has normal neurological and neuropsychological evaluations.	• Type of Evidence – Journal article*: Brain Injury* • Guidelines differ dependant on league, function, and knowledge of team.
Whitehouse & Newcombe, 2023 [63]	SRC is considered synonymous with mTBI and is defined as an alteration in brain function/pathology caused by an	Emphasizing early recognition and adherence to RTP protocols to prevent	**Sideline Care:** • Immediate removal from play is essential if SRC is suspected ("If in doubt, sit them out").	**RTP Protocols:**	• Type of Evidence - Journal article: *British Journal of Hospital Medicine*

	external force. It involves heterogeneous symptoms, with or without LOC or amnesia.	complications like SIS (i.e. education)	• Tools for sideline and emergency assessment include SCAT5, CS test, and GCS. • Observation of red flag symptoms warranting emergency department referral is crucial (e.g. LOC, persistent headache, skull fracture, neurological deficits).	• After 24-48 hours of rest, do graduated RTP with stages progressing from light activities to unrestricted training, with adjustments made if symptoms recur. • Athletes should avoid contact sports until symptom-free for at least 14 days and cleared after 21 days minimum. **Follow-up:** • Primary care or specialists is recommended if symptoms persist beyond 28 days. Persistent PCS may benefit from interventions like cognitive behavioural therapy or neurorehabilitation.	• Adapted with UK Guidance suggestions
Demetriades et al., 2024 **(38)**	A transient, sudden alteration of consciousness caused by traumatic biomechanical forces transmitted to the brain (i.e. direct or indirect trauma).	Preventative strategies suggest increase injury prevention drills in addition to the use of protection, baseline testing, and education. None are enforced.	**Sideline Care:** • **O**n-site initial assessment endorses SCAT5 for diagnosing suspected SRC (i.e. assessments of red flag symptoms, balance, cognition, and neurological function) • Players should be immediately removed from play if a SRC is suspected and should not return the same day without appropriate medical evaluation. • There are differences in sideline treatment across associations.	**Management Strategies:** • **GRTS:** Six stages starting from symptom-limited activity to full RTS. Players progress only if symptom-free and must regress to the previous stage if symptoms recur. • An initial rest period of 24–48 hours is recommended before starting the GRTS (as per CISG). • Differences in management and RTP recommendations across associations (including suggested initial rest, and earliest return date).	• Type of Evidence – Scoping Review, Journal Article: *Brain and Spine* • There are discrepancies in RTP protocols across soccer associations (i.e. FIFA recommends neuroimaging/CT evaluation, differences between standard and enhanced care pathways). • Several nations do not have their own respective guidelines.
Satarasinghe et al., 2019 **(155)**	None given.	No specific preventative strategies are explicitly discussed.	No specific sideline care protocols are discussed in this article.	**Management Strategies:** • RTP guidelines across major leagues typically follow three stages: (1) Rest until symptoms resolve, (2) Re-exertion under medical supervision, and (3) Full return to competition after clearance by a medical professional. There are variances that exist in terms of number of steps and other details (i.e. some leagues have additional requirements and evaluations).	• Type of Evidence - Journal article: *Journal of Experimental Neuroscience* • RTP guidelines from NFL, NBS, MLS, MLB, and NHL summarized.
Elliot et al., 2019 **(156)**	As per 2017 CISG: A complex pathophysiological process affecting the brain, brought on by biomechanical forces.	No specific strategy emphasized. General suggestion of baseline testing.	**Sideline Care:** • Withdrawal from competition is advised in cases of LOC or AMS. UCI emphasises need for removal from competition if SRC is suspected, but there is no established protocol. • SCAT5 and other relevant assessments are suggested.	No RTP protocols are established or explicitly discussed within this article.	• Type of Evidence - Journal article: *BMJ Open Sport & Exercise Medicine*
Swart et al., 2021 **(145)**	Does not provide a clear definition of SRC. Includes key aspects of SRC: a disturbance in brain function resulting from direct or indirect forces to the head.	No specific preventative measures discussed. Suggestions include rule changes to allow for time-outs and enhanced roadside assessment.	**On-field Sideline:** • Context of cycling restricts immediate sideline attention. • Initial screening required to determine if removal from play is needed. Three stage process includes (1) Immediate assessment after a head impact event. (2)	**Management Strategies:** • *2017 Berlin CISG statement* suggestions adopted: RTP guidelines call that cyclists should rest for 24–48 hours post-SRC, followed by a gradual return under a six-stage RTP **p**rotocol. Progression through stages requires symptom-free participation, starting with low-	• Type of Evidence - Consensus statement: *Sports Medicine and Health Science* • Calls for discipline/sport specific guidelines to properly undergo assessment.

			Reassessment immediately post-race or competition. (3) Reassessment the following day to monitor symptom progression. • If warranted, (by MP) immediate and permanent removal is necessary. Re-assessments are suggested to be repeated in the days following the event.	intensity indoor cycling and advancing to normal training and competition.	
Jacobi et al., 2023 [116]	Does not provide a standalone definition.	Preseason activities include player education. Rule changes (i.e. restrictions on blind-side blocks, kick-off play restructuring), and helmet advancements mandated.	**Sideline Care:** • The NFL uses a game-day concussion protocol involving AT spotters (trained to identify PCE) and UNCs. • Initial sideline evaluations use the Concussion Game Day Checklist, incorporating video reviews, neurologic assessments, and event history. "No-go signs" such as LOC or ataxia necessitate immediate removal from play.	The NFL enforces a five-phase **RTP** protocol including (1) Symptom-limited rest. (2) Light aerobic exercise. (3) Sport-specific exercise without head impact. (4) Non-contact training drills. (5) Full-contact practice and clearance for game participation. Players progress through phases without a fixed timeline, monitored for recurring symptoms. Clearance requires evaluations by the team physician and an INC. **Follow-Up Care:** • Players are monitored post-game and reassessed the following day for delayed symptoms (Persistent issues = detailed evaluation) • Players must return to baseline cognitive and physical performance before RTP clearance.	• Type of Evidence - Journal article: *The Musculoskeletal Journal of Hospital for Special Surgery*
Patricios et al., 2023 [131]	None given.	No preventative measures discussed.	SCOAT6 is not designed for immediate sideline care but serves as a post-injury office-based assessment tool- builds on SCAT5 framework with additional diagnosis.	**Management Strategies:** • SCOAT6 provides a systematic approach to track recovery with repeat assessments over time to monitor recovery progress. • Recommendations include rest followed by a gradual return to cognitive and physical activity tailored to symptom status. **Follow-Up Care:** • Emphasizes the need for individualized recovery timelines, as recovery varies between athletes. • PPCS should prompt further investigations and therapies.	• Type of Evidence - Assessment Tool: *Br J Sports Med* • It integrates diagnostic components: (1) Symptom Evaluation (2) Cognitive Screening (3) Neurological Examination (4) Risk Factor Identification. • Uses updated CISG information. • SCOAT6 is not a standalone diagnostic tool; is better suited for detailed, follow-up evaluations.
Patricios et al., 2023 [1]	A TBI caused by a direct/indirect force to the head, neck, or body, resulting in an impulsive force transmitted to the brain. It initiates a cascade of neurophysiological changes (e.g. metabolic disturbances, possible axonal injury). Symptoms may appear immediately or evolve over hours (typically resolve within days), but prolonged recovery can occur.	Portion of 11Rs: Emphasizes suggestions for primary SRC prevention and reduction- such as policy changes (i.e. reduction in practice-related SRC), proper equipment use, and sufficient warm-ups (i.e. NMT).	**Sideline Evaluation/Diagnosis:** • Use of updated tools (e.g. CRT6, SCAT6) for immediate evaluation within 72 hours post-injury. • Removal from play is mandated for suspicion of SRC and certain signs (e.g. ataxia, seizures, or confusion) with required re-evaluation if symptoms persist/evolve. • The **SCOAT6** is recommended for follow-up evaluations starting 72 hours post-injury (for subacute phase).	**Management Strategies:** • Initial relative rest (24–48 hours) followed by a gradual return to cognitive and physical activities, progressing based on symptom tolerance. Strict rest is not recommended. • Early aerobic exercise and structured rehabilitation are beneficial for persistent symptoms (and may begin immediately). **RTS:** • RTS involves six stages, from symptom-limited activity to full-contact practice, requiring at least 24	• Type of Evidence - Consensus statement: *Br J Sports Med* • CISG yields tools such as SCAT6, SCOAT6. Developed for HCP use. • Adding to 11RS from *2017 Berlin CISG statement.*

				hours per step. Full recovery is defined by symptom resolution and the absence of deficits under exertion. There are goals attached to each step of RTS that need to be completed. • Additionally discusses RTL plans with stepwise re-integration into academic related activities.	
du Preez et al., 2022 [144]	The article does not include a universally accepted definition of SRC.	The article does not directly discuss preventive measures.	**Diagnosis Information:** • Differing information with various governing bodies. Five governing bodies provided information on post-contest concussion evaluation. Four bodies referenced the SCAT5, and one used the GCS Scale for initial evaluation. No sideline or diagnostic standard across combat sports.	**Management Strategies:** • Eight governing bodies included RTS protocols- six mentioned mandatory minimum rest periods ranging from 1 to 30 days. Four recommended a graduated RTS protocol, with some requiring medical clearance for competition resumption. • Rest periods and protocols vary widely. Follow-up care information is often missing. The guidelines generally fail to address persistent SRC symptoms or long-term management.	• Type of Evidence - Journal article: *Journal of Science and Medicine in Sport* • Key issues: (1) Poor quality and availability of concussion guidelines across governing bodies. (2) Ambiguities in SRC terminology (i.e. inconsistent evaluations and management) (3) Lack of standardization in medical requirements, such as ringside doctors or trained personnel for accurate assessment.
Davis et al., 2020 [95]	No direct definition given. Adopted statement from 2017 CISG.	Prevention strategies include rule changes (i.e. contact rules) protective equipment, and education programs (targeting athletes, coaches, and medical staff).	**Sideline Care/Diagnosis:** • All organisations implemented protocols for recognising and removing athletes suspected of having a concussion. • Key similarities include (1) Recognition (2) Evaluation: (e.g. SCAT5/Maddocks questions) and (3) Removal: Permanent removal for severe symptoms and temporary removal for evaluation.	**Management Strategies:** • Most organisations implement graduated RTP guidelines, progressing athletes through staged activity levels based on symptom resolution and medical clearance (emphasizing initial rest followed by a graduated RTP protocol. Rehabilitation and referral for persistent or complex cases). • Elite sports with greater resources show stronger enforcement and advanced medical infrastructure, whereas others adapt protocols to the unique challenges of their respective environments.	• Type of Evidence - Guideline summary: *Neurosurgery* • Variations in implementation exist due to differences in sport, region, and resource availability. Similarities: • All organisations incorporate key elements of the Berlin Consensus, including the 11RS • All organisations promote concussion education for athletes, coaches, and medical personnel, through varying delivery methods Differences: • Seen in sport-specific protocol modifications, compliance, and risk prevention focus.
Frémont & Schneider, 2019 [157]	None given. Adopted from *2017 Berlin CISG statement*.	No specified prevention strategies.	• SCAT5 can be useful tool for sideline assessments but should not be used in isolation.	**Management Strategies:** • Prolonged rest until all symptoms resolve is no longer recommended. Instead, initial rest is recommended (short period of 24–48 hours of physical and cognitive rest is advised). Followed by gradual reintroduction of light cognitive and physical activity without symptom exacerbation. • Persistent PCS require reassessment for associated conditions. Individualized treatment plans are recommended for cases of delayed recovery.	• Type of Evidence - Recommendations: *Clin J Sport Med* • Summarizing key messages from *2017 Berlin CISG statement*.

Neidecker et al., 2019 [98]	As per *2017 Berlin CISG statement* definition: A type of mTBI induced by biomechanical forces (direct or indirect).	Education to recognise SRC signs and symptoms. Annual baseline testing is encouraged to establish benchmarks. Proper management of sparring and head strikes during training (unreported injuries can lead to severe outcomes.)	**Sideline Care/Diagnosis Information:** • If a fighter shows signs of SRC during a bout, the fight must be stopped immediately. • Immediate post-bout evaluations are conducted at ringside and repeated in quieter environments to identify delayed symptoms.	**Management Strategies:** • Suspensions vary depending on the severity of the injury: o 30 days for TKO or KO without LOC. o 60 days for a KO with LOC under 1 minute. o 90 days for a KO with LOC exceeding 1 minute. • RTS progresses through aerobic exercise, sport-specific activities, and controlled sparring before full-contact engagement. There are three phases, with three steps within each phase. Beginning from (1) return to general fitness, then (2) return to non-contact fighting, and (3) return to contact. Phase one should not begin for one week following injury, • Follow-up: Clearance for return requires specialist evaluation and resolution of all symptoms. Athletes with symptoms persisting beyond 10 days must be referred to SRC specialist.	• Type of Evidence - Consensus statement: *Br J Sports Med* • Consensus statement given by ARP.
Ellenbogen et al., 2018 [101]	A TBI induced by biomechanical forces, commonly resulting in short-lived neurological impairments that resolve spontaneously. May come from direct or indirect blows.	Development of proper EAP is crucial for management. Pre-season SRC prevention includes proper education and pre-season assessment/baseline.	**Sideline Care:** • Observers include ATC spotters and UNCs who monitor for SRC signs through video review and on-field observation. Madden rule is applicable here. • If SRC suspected, players are removed for evaluation using the NFL Sideline Concussion Assessment in a private medical tent. Players with "No-Go" signs (e.g., LOC, disorientation, seizures, amnesia) are immediately removed and prohibited from returning that day.	**RTP:** • Each SRC injury treated individually, with no standardised time frame for full RTS. Decision to return made by team physician and/or INC. • Player must complete stepwise RTP protocol following relative rest. Rate of progression and timeline is determined by MP. An example of a graded RTP is provided, but individually modified (5 steps, followed by medical clearance). **Follow-up:** • A Locker Room Comprehensive Concussion Assessment is performed the day after injury to monitor evolving symptoms. • Persistent symptoms prompt further neuropsychological testing and evaluation by specialists**.**	• Type of Evidence - Consensus statement: *Br J Sports Med* • Statement discussing NFL HN&S committee protocols. • The **Madden Rule** mandates that any NFL player diagnosed with a concussion must (1) Be removed from the field of play. (2) helmet taken away to prevent re-entry into the game. (3) Be escorted to the locker room and (4) observed in locker room by qualified MP.
Nalepa et al., 2017 [161]	None given.	No prevention strategies included. Suggested future directions include development of educational efforts, uniform rules, and baseline testing.	The article does not explicitly detail sideline evaluation protocols.	**RTP:** • A two-phase RTP protocol is recommended: o **Phase 1:** Gradual return through aerobic exercises (e.g., biking, jogging) and sport-specific drills (e.g., shadow boxing, mitt/bag work) in a controlled environment beginning from rest. This phase mimics 5 step RTP from CISG. o **Phase 2:** Gradual reintroduction to sparring with increasing intensity (Bag/mitt work with movement, Shadow boxing in the ring with	• Type of Evidence - Journal article: *The Physician and Sports Medicine*

				gloves and headgear, One-sided sparring, Short-duration sparring). This phase is broken into 6 steps. ○ **Phase 3:** A full return to contact sports. • A daily symptom log is recommended to track progress and symptom recurrence. The article does not explicitly provide details on follow-up care or prognosis beyond the importance of adhering to RTP protocols.	
Abreu et al., 2016 [106]	A subset of mTBI, characterized by a transient disturbance in brain function. It is primarily a functional injury resulting from various forces on the brain, with symptoms often evolving over minutes to hours.	Emphasises advancements in equipment technology (e.g. NOCSAE, HIT, HITS).	**Sideline:** • Athlete suspected of SRC should be removed from play until MP determines positive or negative diagnosis. Standardized approach must be used (e.g. SCAT, NFL Checklist, BESS).	Management: • Standardized testing should be repeated until condition is found stable. • Initial management includes physical and cognitive rest until symptoms subside, avoiding activities that exacerbate symptoms. • Gradual RTP progression involves individualized steps based on symptom resolution. Activity should be paused and restarted after 24 hours if symptoms recur.	• Type of Evidence - Journal article: *The Sport Journal* • Discusses importance of equipment regulation, and avoidance of premature RTP (i.e. CTE, SIS).
McCrory et al., 2017 [3]	A TBI caused by biomechanical forces. Common clinical features include direct or indirect force to the head, and a rapid onset of short-lived* neurological impairments that resolve spontaneously. *Clinical signs and symptoms may evolve over minutes to hours and do not always involve LOC.	Preventative methods should include pre-participation assessments, proper education, protective equipment, and policy changes.	**Sideline evaluation:** • Removal from play for any suspected SRC. • Use of tools like SCAT5 for rapid screening, including Maddocks questions and SAC. • There must be immediate medical assessment in a distraction-free environment. Serial evaluations are critical due to the potential for delayed symptom onset.	**Management Strategies:** • Initial Rest should involve a short period of physical and cognitive rest (24–48 hours). • Gradual RTP progression: 1. Symptom-limited daily activities. 2. Light aerobic exercise. 3. Sport-specific exercises without head impact. 4. Non-contact training drills with resistance training. 5. Full-contact practice with medical clearance. 6. Return to normal gameplay. *Each stage should last a minimum of 24 hours, and any recurrence of symptoms requires regression to the previous stage. Persistent symptoms require comprehensive evaluation.	• Type of Evidence - Consensus statement: *Br J Sports Med*
Casey & Fonseca, 2019 [75]	Concussions are a form of TBI resulting in neurological problems, with the injury itself being caused by a trauma somehow involving an impact to, or jarring of, the head. MOI is linked to severity of injury. Common symptoms can include a variety of physical, cognitive, emotional, and visible signs of concussion (e.g. headache, dizziness, difficulty with normal	**Preventative Methods:** Regularly updated education for all stakeholders (including use of CRT5). Tools may include online courses for HCP. Federal recommendations include mandatory SRC protocols and consistent application across provinces/organisations (i.e.	**Sideline Care/Diagnosis Information:** • **On-Site Medical Assessment:** If licensed HCP's are available, they should use the SCAT5 to conduct evaluations in a quiet, controlled setting. Assessment conducted by licensed HCP. • Athletes showing any symptoms or signs of SRC must be immediately removed from play and referred to an HCP for a detailed assessment. If proper medical assessment results in negative signs for SRC, they may return to sport. Monitoring of signs must continue.	**Management Strategies:** • **Initial Rest:** Athletes should rest for 24–48 hours, both physically and cognitively, before gradual reintroduction to activities. • **RTS:** Stepwise progression tailored to each athlete, advancing from light aerobic exercise to full-contact practice and finally game participation (6 steps). Athletes must receive medical clearance before RTS. Similar stepwise integration of cognitive activities into the school environment before resuming sports if applicable. Medical assessment letter must be used. Medical clearance letter is required by HCP prior to full re-integration.	• Type of Evidence - Report of the Standing Committee on Health & Subcommittee on Sports-Related Concussions in Canada (Government Report) • Parachute Canada (i.e. Canadian injury prevention organisation) does not recommend mandatory baseline testing, as its necessity is debated in concussion care. • Discusses *2017 Berlin CISG statement* within best practices. This document is a summary of the

	function, irritability, confusion, LOC).	rule changes, equipment). All preventative suggestions should be sport-specific.	• Red-flag signs, such as LOC or severe neurological symptoms, necessitate immediate transportation to a hospital.	**Follow-Up Care/Prognosis:** • Athletes with persistent symptoms (longer than 4 weeks in youth, 2 weeks in adults) should be referred to multidisciplinary concussion clinics for specialized care, including neurology, physiotherapy, and psychology. • Follow-up care emphasizes individualized treatment plans and monitoring of symptom progression.	*Canadian Guideline on Concussion in Sport* (aligned with CISG). • **COPSI** mandates all high-performance athletes have a range of pre-season baseline testing, removal for suspected concussion, RTP protocols, assessments for SRC, and on-site HCP for all practices. These are modified to be sport specific.
England Football, 2023 [64]	A brain injury resulting in a disturbance of brain function, impacting physical and cognitive aspects. Common symptoms may include headache, dizziness, and memory or balance issues and can appear immediately or delay onset within the 24-48 hours following the injury event. SRC is caused by either a direct/indirect blow (head or body) or rapid movement of head (i.e. whiplash).	Baseline suggested for professional and high-level players (enhanced care pathway available only in professional clubs, international teams, or academies).	**Sideline Care/Diagnosis Information:** • Any player suspected of having SRC must be immediately removed from play and not return the same day. The principle is: **"If in doubt, sit them out."** • Sideline evaluations may use the CRT6 and observable signs like balance issues, confusion, or unusual behaviour. • **Red Flag Signs:** Immediate medical attention is required for symptoms such as LOC, repeated vomiting, severe headache, or neurological deficits.	**Management Strategies:** • **Initial Rest:** A 48-hour period of relative physical and cognitive rest is recommended, avoiding intense physical or mental activities. • **GRTP Programme:** Six stages include: rest, light aerobic exercise, football-specific exercises, non-contact training, full-contact training (with medical clearance), and RTP. Each stage requires at least 24 hours, and players must not progress if symptoms worsen. • Enhanced pathway like the standard six-stage GRTP programme but with stricter medical supervision (i.e. Stages 1–4 require at least 14 days… Full RTP is allowed on **Day 12** only under exceptional circumstances).	• Type of Evidence - England Football Concussion Guidelines • Provides easily accessible information for how to act, questions to use, and actions to take in case of SRC. • Enhanced care pathway available for elite players, involving stricter oversight, pre-injury baseline testing, and multidisciplinary supervision (e.g. use of SCAT6 Baseline). Early RTP may be considered only with certain criteria (i.e. No significant or recurrent SRC in the past, etc.)
ECB, 2024 [55]	SRC defined as a TBI caused by a direct blow to the head, neck, or body resulting in an impulsive force transmitted to the brain. Involves functional rather than structural brain changes, with symptoms evolving over minutes to hours. LOC is not necessary for diagnosis.	Welfare of players must be prioritised. ECB mandates baseline testing and protective headgear.	**Initial On-Field Assessment** • Players suspected of SRC must be removed from the field and evaluated by a HCP. The principle is: *"If in doubt, sit them out."* • Use of CRT6 for initial sideline evaluations and SCAT6 for follow-up. Modified Maddocks questions tailored to cricket assess orientation and awareness. • **Red Flags**: Indicators requiring immediate hospital transfer include LOC, seizure, repeated vomiting, or increasing confusion.	**Management Strategies:** • Anyone with suspected or confirmed SRC should not: be left alone in first 24 hours, consume alcohol, drive a motor vehicle • **Initial Rest:** 48 hours of relative physical and cognitive rest are recommended, avoiding screen time and heavy activities. • **GRTP:** Six-stage progression with two GRTP pathways provided (distinguishes between professional/elite players and other levels of play). • Professional: Minimum of **7 days** for GRTP progression, provided symptoms resolve and medical clearance is obtained. Includes higher intensity of exercises, tailored to the demands of elite cricket, such as sport-specific skills and advanced fitness drills during non-contact phases. **Medical Oversight for Professional/Elite Players**: • Requires close monitoring by sports HCP trained in SRC care. • Daily assessments during RTP progression, with frequent SCAT6 or similar evaluations. • Independent medical clearance before resuming competitive play.	• Including adaptations from ICC Concussion Guidelines, *2022 Amsterdam CISG statement*, IOC Injury Prevention Conference, and UK Guidelines for Sport 2023. Meant for HCP's. • "When in doubt, sit them out." • References 12R's of *2022 Amsterdam CISG statement* (Recognise, Reduce, Remove, Re-Evaluate, Rest, Refer, Rehabilitation, Recovery, RTS, Reconsider, Retire, Refine)

NFL HNSC, 2022 [81]	SRC is TBI induced by biomechanical forces. Features of this injury may include a direct or indirect blow (to head, body, face, neck, etc.) with impulsive forces transmitted to the head.	Every NFL venue must have an approved EAP, with roles assigned to medical staff, clear trauma transport pathways, and nearby access to trauma centres.	**Sideline Care/Diagnosis Information:** • Spotters and UNCs use video replay and live observations to monitor for concussion symptoms. • **Sideline and Locker-Room Assessments:** Players showing "No-Go" signs (e.g., LOC, ataxia, confusion) are immediately removed. Evaluations (e.g. NFL Sideline Concussion Assessment, modified from SCAT5) and further assessment in the locker room.	**Game-Day Management**: • Players diagnosed with SRC are prohibited from returning to the game. Serial evaluations are conducted to monitor symptom progression. Players undergo follow-up evaluations the day after the game, with comprehensive neurological and symptom assessments. Players are cleared to resume everyday activities only after medical approval. **RTP Protocol**: • A structured five-phase recovery process: 1. **Symptom-Limited Rest**: Physical and cognitive rest. 2. **Light Aerobic Exercise**: Supervised cardiovascular activity. 3. **Football-Specific Drills**: Gradual reintroduction of movement drills. 4. **Non-Contact Practice**: Controlled activities without physical contact. 5. **Full-Contact Play**: Return to games after clearance from team physicians and Independent Neurological Consultants (INCs).	• Type of Evidence - NFL HN&S Concussion Protocol • **Madden Rule:** Players diagnosed with a SRC are removed from the game, their helmet is confiscated, and they are evaluated in a quiet locker room environment. • Emphasises collaboration between team physicians, UNCs, and INCs ensures unbiased medical decisions.
AFL, 2022 [121]	An mTBI caused by direct/indirect trauma to head or body with force ultimately transmitting to the head. Sudden movement can impact the brain with temporary effects on normal brain function.	Players, coaches, and officials receive mandatory training on concussion recognition and management. Includes specialised training for HCP.	**Sideline Care:** • **Immediate Response**: Any player suspected of having a SRC must be removed from play immediately *("If in doubt, sit them out").* • Players should be assessed for SRC signs by trained personnel using validated observation and symptom-checking techniques. Preliminary assessment done by trained HCP equipped with up-to-date protocols (with clear steps for validated assessments, SRC detection, etc.) • No explicit tools or stepwise sideline assessments are mentioned in the document for diagnosing or managing concussions.	**Management Strategies:** • AFL emphasizes a holistic and evidence-based approach to care, including recovery throughout RTP. While the document emphasizes the need for players to recover fully before returning to play, no specific stepwise protocol is outlined for RTP progression. Decisions are based on individual recovery and medical clearance.	• Campaigns aim to destigmatize concussion reporting and emphasize safety. • The **HeadCheck App** is utilized at the community level to guide early recognition and management. • Elite protocols include Hawk-Eye video reviews, advanced diagnostics, and expert concussion panels, while community-level guidelines focus on practicality and accessibility.
British Cycling, 2023 [65]	SRC is described as a brain injury resulting in a disturbance of brain function. It can be caused by direct head impacts or transmitted forces from other parts of the body, such as a whiplash injury. The injury affects four main areas (i.e. physical, mental, mood, sleep). Symptoms include headache, dizziness, balance	Helmets are required for BC – additional equipment should be fitted correctly.	**Sideline Care:** • **Immediate Removal**: Any participant suspected of SRC must be immediately removed from cycling activities, with the principle: **"If in doubt, sit them out."** Participants should not return to cycling the same day. Video footage must not be used to contradict an SRC decision (used for MOI). • No explicit tools or assessments recommended.	• **Initial Rest**: A 24–48-hour period of physical and cognitive rest is recommended. Activities like walking or light reading are permitted if symptoms remain mild . • **Gradual Return to Activity**: After the rest period, participants follow a stepwise return to normal life (education/work) and sport. Activities must not worsen symptoms beyond a mild level. Early introduction of exercise shown to be helpful. • Participants with persistent symptoms beyond 28 days should consult an HCP experienced in managing SRC.	Concussion Guidelines produced by BC, following *2017 Berlin CISG statement* guidelines. *Elite riders on GBCT have separate guidelines.

	issues, and concentration problems.				

FIBA, 2024 [85]	SRC is a TBI caused by biomechanical forces applied directly to the head or indirectly through other parts of the body. It results in a rapid onset of neurological impairments, which may evolve over time. Symptoms generally resolve without medical intervention, but recovery should follow a structured protocol overseen by MP.	Preseason baseline is required.
		
		Briefly highlights education of stakeholders.
			Sideline Care:
			• **Immediate Removal**: Any player with a suspected or confirmed SRC must be removed from the game or training and assessed by a medical professional. They may not return to the same game under FIBA policy.
			• **Assessment Tools**: **SCAT6** is the recommended tool for SRC assessment and should be used by the team doctor or physiotherapist. If a thorough assessment cannot be conducted immediately, it can be delayed until half-time or the end of the game, provided the player does not re-enter play.
			• **Red Flags**: Emergency referral is required for signs such as seizures, repeated vomiting, worsening confusion, or LOC.
			• Video review should confirm the injury mechanism and assist in detecting missed concussion signs
				Management Strategies:
				• A period of 24–48 hours of relative rest is recommended. Full physical and cognitive rest until symptom resolution is not advised, as early, mild activity may benefit recovery.
				• The GRTP consists of five stages, each requiring at least 24 hours and progression only when symptoms do not worsen:
				  ○ (1) Light aerobic exercise
				  ○ (2) Basketball-specific skills: Free throws, shooting, and non-contact activities involving movement and neck/head positioning.
				  ○ (3) Limited-duration team training: Full-intensity non-contact training for 20–30 minutes.
				  ○ (4) Full-contact practice: Following medical clearance.
				  ○ (5) Return to play
				
				• Players can only return to full competition after clearance by a team doctor, with baseline cognitive and neuropsychological assessments returning to pre-injury levels.
					Only the team doctor can clear players for RTP after completing the GRTP protocol.

FIFA, 2024 [56]	SRC is TBI caused by a direct blow to the head, neck, or body, resulting in an impulsive force to the brain. It results in a functional disturbance, often involving a neurotransmitter cascade and inflammation. Symptoms may appear immediately or evolve over minutes, hours, or days. Recovery generally occurs within days but may sometimes take longer.	FIFA Pre-match EAP to aid in management of SRC. Baseline examination at pre-season (SCAT6).	**Sideline Care:** • **Immediate Removal**: Players suspected of SRC must be removed immediately and not return on the same day, following the principle: *"If in doubt, sit them out".* • **On-Pitch Assessment**: Initial examination involves observing visible signs (e.g., tonic posturing, ataxia, or LOC). Medical teams should also assess GCS scores, orientation, and memory using tools like SCAT6. Video review is recommended to find MOI.	**Management Strategies:** • **First 72 Hours**: Repeated assessments for symptom evolution are recommended to confirm diagnosis and guide care. • **GRFP**: A six-stage progression includes (1) Symptom-Limited Activities (2) Light Aerobic Exercise: (3) Football-Specific Drills 4) Non-Contact Training (5) Controlled Contact Practice (6) Return to Full Competition. • Players must remain symptom-free for 24 hours at each stage and regress if symptoms recur. **Follow-Up:** • Players should be observed for 72 hours post-injury to identify delayed symptom onset. • Symptoms lasting beyond 28 days require referral to specialists for comprehensive evaluation and treatment • Final clearance must come from the team doctor or a brain injury specialist	Protocol specifies "red flags" (indicate life-threatening injuries) and "yellow flags" (non-urgent impairments requiring further assessment).
NHL, 2022 [109]	No explicit definition provided. Description of SRC references Berlin CISG definition.	Baselines testing and education are emphasised.	**Sideline Care:** • **Mandatory Removal**: Players exhibiting visible signs of SRC, such as lying motionless, motor incoordination, or a	**Management Strategies:** • **Initial Rest**: 24–48 hours of physical and cognitive rest are recommended. Players then follow a gradual, individualized recovery plan.	• Type of Evidence – Web Source • Consistent with *2017 Berlin CISG statement.*

		Compliance of policies are emphasised- clubs face fines for failing to remove players for mandatory evaluations or neglecting protocol requirements.	vacant look, must be removed for evaluation. Symptoms that develop later (e.g., headache, dizziness) also mandate removal. • Evaluations are conducted in a distraction-free environment using tools like the SCAT5 App. Focused neurological examination and video review of the incident mechanism are mandatory. • Typical "red flag" symptoms sanction hospital transfer.	○ **Graded RTP:** Includes six stages of recovery with each step requires a minimum of 24 hours symptom-free before advancing: 1. Symptom-limited activity (light daily activities). 2. Aerobic exercise (e.g., stationary cycling). 3. Non-contact training drills (e.g., skating). 4. Non-contact on-ice activity (sport-specific movement). 5. Controlled contact drills (on-ice body contact). 6. Full unrestricted play (competitive games). • Constant monitoring of symptoms. Any evolving after the initial evaluation (24–48 hours) necessitate further assessments. • RTP decisions must be confirmed by the Club Physician and Consulting Neuropsychologist based on neurocognitive and neurological baselines	
NBA, 2017 [133]	The NBA uses the 2017 Consensus Statement from the CISG.	Education and baseline testing are mentioned as preventative strategies.	• Specifics of sideline care and diagnostic information is not included. Players diagnosed with SRC are prohibited from returning to play on the same or next day. • If a player shows signs or symptoms of SRC, they are removed from participation for evaluation by a TDD or AT in a quiet, distraction-free environment. Players not diagnosed during initial evaluation are monitored (24 hours), reassessed before the next game or practice. Any delayed symptoms necessitate immediate removal and re-evaluation.	**Management Strategies:** • **Initial Rest**: Players diagnosed with SRC undergo a brief rest period with limited physical and cognitive exertion. No specific rest period provided. Supervised gradual resumption of activities is encouraged. **RTP Process**: 1. A structured process involving increasing levels of exertion (i.e. moving from stationary biking, jogging, agility drills, to non-contact team drills). 2. Players must remain symptom-free at each stage to progress. If symptoms recur, the player returns to the previous step. Neurological exams are held at each stage, with no return timeframe provided.	• Type of Evidence – NBA Concussion Policy • Consistent with *2017 Berlin CISG statement.* • NBA Concussion Program Director is informed of the results and are involved in team physician decisions. Coordinated care is emphasised in all portions (team physician makes the final decision).
NCAA, 2023 [66]	SRC is a type of TBI caused by a direct blow to the head, neck, or body, transmitting force to the brain during sports or exercise. It triggers a cascade of neurotransmitter/metabolic changes affecting the brain. Symptoms may appear immediately or within hours, typically resolving in days or longer. Symptoms vary widely and may or may not involve LOC.	Pre-season education (i.e. SRC fact sheets, SRC material) provided for stakeholders. Baseline assessment as part of a pre-participation assessment. Recommendations to reduction of head impact exposure are included (i.e. adherence to policy, equipment). EAP plans for SRC event must be included.	**Sideline Care/Diagnosis:** • Removal is mandatory. Athletes displaying signs/symptoms of SRC must be removed from play immediately. May only return same day if SRC is not suspected after evaluation. • A thorough multimodal assessment is required, including symptom evaluation, cognitive and balance testing, and neurological exams. • Trained medical personnel must be present at all NCAA competitions in	**Off-field Same Day Management:** • Serial assessments are conducted during the first 72 hours post-injury and periodically after, with documentation of post-SRC plan. **Subacute (72 hours-weeks) Post-Injury Management:** • Following initial rest, symptom-limited light aerobic activity can begin within 24–48 hours. • **RTS Protocol:** A supervised six-step progression is mandated, typically requiring at least 24 hours per step. All medically cleared and supervised. ○ (1) Symptom-limited ADL	• References *2022 Amsterdam CISG statement* for guidelines and SRC definition (including discussions of imaging). • The NCAA produced the *NCAA Concussion Safety Protocol Template*, which is a resource provided by the NCAA to assist member schools in developing and implementing safety protocols that comply with NCAA regulations. It acts as a customizable guide for institutions to address essential

			contact/collision sports and available during practices • **Emergency Care**: Immediate transport to a hospital is necessary for severe signs like seizures, double vision, or deteriorating consciousness	○ (2) Aerobic exercise (light to moderate intensity) ○ (3) Individual sport-specific activities w/o head impact risk ○ (4) Non-contact practice with progressive resistance training ○ (5) Unrestricted practice/training ○ (6) Full return to competition	aspects of SRC management (i.e. education, evaluation, treatment, and prevention strategies) using the information from this document.
NICE, 2023 [141]	NICE uses 'head injury' as defining term. **SRC** is considered within the broader scope of head injuries and is defined as a trauma to the head, outside of superficial facial injuries. This is inclusive of closed head and penetrating head injuries.	Prevention methods include training for HCP (e.g. GCS assessment/safeguarding practices), an improvement of public awareness (i.e. educational campaigns), and some guidelines for imaging (i.e. CT, MRI).	• Emphasis on EMS and access to NHS when there is observation of risk factors (e.g. LOC, neurological deficits, high-energy SRC, etc.). • No specific assessments or sideline assessments included within guideline.	**Management Strategies:** • All acute care is given with instructions for EMS providers. There are no sport-specific management practices included. Recommendations for hospitalized patients are provided (i.e. medication, imaging, radiation, CS assessment). • Recommends neurological referrals in cases with deteriorating GCS, unexplained confusion, or progressive neurological signs. • Discharge is considered safe if GCS has returned to 15, imaging is normal, and adequate home supervision is available.	**Term of 'SRC' or 'Concussion' is not used. NICE uses 'head injury' as defining term. For this study's purposes, 'SRC' will be used rather than 'Head Injury'.* These guidelines provide evidence-based recommendations for the evaluation, treatment, and follow-up care of SRC, and are meant for HCP, patients, families, and care providers.
NRL, 2021 [93]	SRC is defined as falling within the spectrum of TBI (mTBI). It results from a direct/indirect blow to the head or body, causing an impulsive force transmitted to the brain. This leads to functional brain disturbances. Symptoms of concussion include headache, dizziness, balance problems, confusion, and memory difficulties, which may resolve quickly or persist over time.	The document does not explicitly outline preventative measures.	**Sideline Care/Diagnosis:** • Players showing signs of SRC (e.g., confusion, memory loss, or balance problems) are immediately removed from play for evaluation. Steps must include immediate recognition, removal, and reference to MP. • Sideline assessments to identify symptoms and signs of concussion (e.g. CRT5) • Players with severe symptoms (e.g., LOC, seizures, headache, or vomiting) require ambulance transport/ hospital evaluation	**Management Strategies:** • Players are advised to rest physically and cognitively (24–48 hours) before resuming light activities. • Six staged GRTS process (requires players to remain symptom-free for at least 24 hours at each stage) ○ (1) Symptom-limited daily activities. ○ (2) Light aerobic exercise. ○ (3) Sport-specific drills (no head impact). ○ (4) Non-contact training. ○ (5) Full-contact practice (with medical clearance). ○ (6) Return to competition. • Monitoring is ongoing. Players diagnosed with SRC must be monitored for delayed symptoms. Persistent symptoms (>28 days) require specialist referral (i.e. may involve neurologists, physiotherapists, and psychologists for comprehensive care). There are no defined mandatory periods of time that a player must be restricted from play.	• Type of Evidence - Guidelines: *NRL Participation, Game Development, and Community* • References and adapts guideline statements from *2017 Berlin CISG statement*. • Emphasises basic first aid principles to be applied at any signs of LOC or emergency.
ASC, 2024 [86]	Using CISG statement SRC definition: SRC is a type of TBI caused by biomechanical forces. Often resulting from an impact to the head, face, neck, or body that transmits force to the head. Concussion typically causes temporary neurological	Pre-season baseline neurocognitive testing is considered useful.	• Common tools are linked (e.g. SCAT6). General first aid and CS assessments are emphasised, with common 'red flag' and SRC symptoms are provided ranging from critical to subtle (e.g. neck pain, LOC, vomiting, etc.) A clinical history, including MOI, and SRC assessment must be completed.	**Immediate Management** • If diagnosed with SRC, immediate management is physical and cognitive rest (i.e. relative rest from cognitive activity for 24 – 48 hours after injury). The athlete then can begin moderate intensity PA - with no significant or sustained deterioration in symptoms. • Graded RTP frameworks are recommended for MPs to implement. Management may also include dealing with mental illness, and resources are provided.	• Web-based resource summarizing *Concussion in Sport Australia Position Statement* and *Concussion and Brain Health Position Statement 2024*, designed to help support MP with SRC diagnosis and management. • Principle of "If in doubt, sit them out".

	impairment, with symptoms evolving over hours or days.		• As a minimum, any athlete with suspected SRC should be immediately removed from sport, assessed, and monitored. No athlete should RTP on the day of injury if concussed.	• Discusses risk of CTE because of repeated head trauma. SIS is briefly mentioned.	
Rugby Australia, 2019 [126]	SRC is a complex pathophysiological process requiring clinical diagnosis. It results from trauma, leading to transient changes in neurological function, and disturbances in brain function (i.e. functional rather than structural).	There are no preventative measures for SRC explicitly outlined in the text.	• A conservative approach is urgently emphasised, and players must be treated as having SRC if there is doubt. Players with suspected SRC are immediately removed from play and assessed. Criteria 1 signs (e.g., LOC, ataxia) mandate permanent removal. No tool can diagnose SRC sufficiently without clinical suspicion. • **First Assessment: Time of Injury:** If there are 'red flags' of any kind, EMS must be contacted (criteria 1). Criteria 2 symptoms (e.g. suspicious MOI, confusion, etc.) require further evaluation. • **Second Assessment (2-3 hours post SRC):** Assessment tools should be used to assist clinical diagnosis. Abnormalities in assessment are assumed to be due to SRC.	**Management:** • **Third Assessment (36-48 Hours Post SRC):** Neurological assessments using tools (e.g. AU Referral and Return Form, SCAT5) performed by HCP. Any abnormalities in scores are considered to be positive SRC diagnosis • **8Rs Process:** used by Australian Rugby as guidance for SRC management. • **Graded RTP:** A staged approach, with mandatory rest periods and gradual activity progression. Players may progress with minimum of 24 hours between stages. AU Referral and Return form must reflect these. o (1) Rest (HCP decided amount of time) o (2) Light cardiovascular exercise. o (3) Rugby-specific exercise. o (4) Rugby-specific non-contact training. o (5) Full-contact practice (requiring medical clearance). o (6) Rugby game (with symptom monitoring).	• The document integrates protocols from Rugby Australia, World Rugby, and international best practices. • Main Principle: **"Recognize and Remove"** – recognise SRC event and remove player without allowing them to return the same day. 8R principle outlines a step-by-step procedure summary, available within this document. • Advanced care pathway available for elite competitions. • **The Blue Card:** An initiative to aid players suspected of SRC, triggering mandatory removal and evaluation.
Echemendia et al., 2023 [142]	The SCAT6 is based on the guidelines from the CISG. No explicit definition is provided in this document.	Recommendations of pre-season baseline assessment are included, but not required by SCAT6.	**Sideline Care:** • Immediate removal from play is mandatory for suspected SRC, with no return on the same day of injury. • Assessments for SRC diagnosis (such as SCAT6) should not be used in isolation. Immediate first aid principles are required to be followed in case of emergency. • **Off Field Assessment:** Includes portions on athlete background, additional symptom evaluation, cognitive screening, and additional testing (e.g. memory, concentration, etc.)	This document focuses exclusively on the evaluation/assessment of suspected SRC, and it does not provide detailed guidance on management, follow-up care, or RTS protocols.	• Type of Evidence - SCAT6 SRC Assessment: *Br J Sports Med*
Elkington et al., 2019 [41]	SRC is a TBI caused by biomechanical forces to the head or body, transmitting impulsive forces to the brain. It results in short-lived neurological impairment, with symptoms evolving over hours or days. The injury does not involve structural abnormalities but includes	Education programmes must occur to improve awareness. Additional measures such as appropriate equipment and rule changes are briefly mentioned.	**Sideline Care:** • Remove athletes from play immediately if SRC is suspected. • Any critical symptoms (i.e. LOC, seizures, etc.) require EMS attention. First aid principles should be prioritised (i.e. assess airway, breathing, circulation, and CS injury). • A comprehensive clinical history and neurological exam, including cognitive and	**Management:** • Initial rest includes physical/cognitive relative rest for 24–48 hours. • Graduated RTS protocol following rest includes moving from: light aerobic exercise, non-contact basic sport-specific drills, complex sport-specific drills (no contact), full contact practice (medical clearance and review required), and then finally normal competitive activity. Each step requires 24 hours at each, with no recurrence of symptoms to allow progression.	• Type of Evidence - Position Statement: *Australian Institute of Sport* • Principle of "If in doubt, sit them out".

	physiological changes affecting function.		balance testing, should be conducted (e.g. CRT5, SCAT5). Official diagnosis should be made by MPs with comprehensive evaluation.	• Persistent symptoms and complications sanction additional testing and evaluation (concerns of CTE, SIS).	
SMA, 2018 [78]	SRC are described as a disturbance in brain function, not a structural injury, caused by a direct or indirect force to the head, neck, or body, with forces transmitted to the brain/head. Medical diagnosis is required.	Education is considered one of the best ways to approach SRC, including the most up-to-date information available. A designated concussion coordinator is also beneficial.	**Recognition/Immediate Care:** • If symptoms/signs (e.g. lying motionless, headache, drowsiness, LOC, etc.) are present, remove the player immediately. The player should not RTP until medically assessed. • Severe head or spinal injuries require EMS attention and hospital transfer. First aid should be prioritised. • Assessments (CRT5) should be used to evaluate symptoms, function, and signs.	**Management** • A player removed for suspected or confirmed SRC must not RTP for at least 48 hours. Assessment by an MP is required. • Following 24-48 hours of physical/mental rest, there is a six-stage RTP progression to follow. Beginning with (1) daily activities, (2) light aerobic exercise, (3) sport-specific exercise, (4) non-contact drills, (5) full contact training (with MP clearance), and finally (6) RTP (all steps without symptom recurrence). 24 hours must occur between stages.	• Type of Evidence - Concussion policy: *Sports Medicine Australia* • The policy aligns with international standards, such as the *2017 Berlin CISG statement.*
World Rugby, 2024 [115]	A TBI resulting in brain function disturbance. This can be caused by either direct or indirect blows to the head or body, resulting in rapid movement of the head (i.e. Whiplash).	There are no preventative measures for SRC explicitly outlined in the text.	**SRC Recognition:** • Players with suspected SRC must be immediately removed from play/training following the *"recognise and remove"* principle, and players may not return to the field the same day. • All stakeholders are required to be aware of SRC signs/symptoms. Specific assessments are sideline protocols are not provided. • HIA protocol applicable in elite competitions to evaluate signs, symptoms, and cognitive function.	**Management** • The first 24 hours following injury should include relative rest, with light activity beginning 24-48 hours after the event. Minimum RTP for adult players (following rehabilitation programme) is 21 days, unless player falls within 'advanced' level of care. **Individualised Rehabilitation** • Gradual RTS programme adopted from *2022 Amsterdam CISG statement* suggestions. This includes moving from symptom-limited activity, through to a full RTS in six steps. An example RTS process is provided, but this may be individualised dependant on patient needs and medical suggestion. Recovery should be monitored through this process, with no symptom regression or worsening. • Advanced care sanctions an additional multidisciplinary approach, with difference standards of RTP (shorter than 21 days).	• Type of Evidence - Concussion guide: *World Rugby* • "Recognise and remove, and if in doubt, sit them out".
Parachute, 2024 [57]	Using CISG 6th statement definition: SRC is a type of brain injury (TBI) caused by biomechanical forces. Symptoms (i.e. headache, dizziness, confusion, etc.) often resolve within four weeks, with official diagnosis based on clinical examination.	Proposes three levels of prevention for SRC. Primary prevention targets immediate aspects (e.g. rule changes, equipment, NMT). Secondary methods include appropriate removal timing and enforce/informed SRC protocols. Lastly, tertiary prevention includes policies to prevent recurrent SRC issues.	**Immediate Actions**: ○ Remove athlete from activity immediately if SRC is suspected. ○ Watch for red flags (e.g., loss of consciousness, convulsions, worsening headache) that signal emergency care. **Sideline Assessment**: ○ Use SCAT6/Child SCAT6 if a licensed HCP is available.	**Initial Management**: ○ Relative rest for 24–48 hours. ○ Gradual reintroduction of cognitive/physical activities as tolerated, avoiding exacerbation.. Guidance provide return to school approach (with stepwise approach) if applicable. **Stepwise RTS Strategy**: ○ Relative rest and light daily activities. ○ Light aerobic exercise (e.g., walking, stationary cycling). ○ Individual sport-specific drills (no contact). ○ Non-contact training with increased intensity.	• Concussion Guidance: *Parachute* • The guideline aligns with international standards, such *2022 Amsterdam CISG statement.* • Emphasis on collaboration, use of key tools (e.g. SCAT6, Medical clearance letters, CRT6).

		Pre-season education for all stakeholders is additionally emphasized.		○ Full-contact practice after medical clearance. ○ Full RTS. **Aftercare/Persisting Symptoms** ○ Persistence of symptoms requires interdisciplinary care tailored to individual needs. ○ Medical clearance is needed for full-contact activities. If symptoms return, the athlete must revert to earlier steps in the strategy.	
The Danish Concussion Center, 2021 [146]	No specific definition for SRC is provided in the guideline.	The guideline does not address prevention of SRC.	The guideline does not cover immediate sideline care or diagnosis methods.	• Several suggestions were graded as either strong, weak, conditional, or good practice. • Best practices (i.e. 'good practice' or 'strong recommendations') include oculomotor vision therapy, increased multidisciplinary collaboration, and early/timely management. • Weak recommendations (i.e. intervention results are better than not doing them) include graded physical exercise (i.e. they suggest this is weak in isolation and should be done in collaboration with other treatment).	• Concussion recommendation guide: *The Danish Concussion Center* • Acts as a quick guide containing various recommendations. The focus is on PCS and non-pharmacological treatments.
UK Government, 2021 [147]	Using *2017 Berlin CISG statement* definition: SRC is a TBI caused by biomechanical forces, typically resulting in rapid/ temporary neurological impairments. It may arise from direct or indirect impact to the head/body, causing functional disturbances. Symptoms may evolve over minutes to hours, persist in some cases, and may or may not involve LOC.	Several education initiatives are promoted within this report, such as standardising SRC protocols to ensure consistent messaging across sports.	The report does not detail specific sideline care or diagnostic methods, it instead focuses on broader responsibilities.	• The management strategies outlined in this government document do not emphasize specific steps, such as RTS progressions. Instead, the focus is on the importance of SRC prevention and treatment innovation, along with promoting the development of consistent protocols. The report lacks detailed clinical follow-up or prognosis information.	• Type of Evidence - Concussion publication: *UK Government* • Shares ideas with programs like the FA's "If in Doubt, Sit Them Out."
ACC, 2024 [58]	There is no specific definition for SRC provided. Important aspects of SRC include discussions of SRC as a brain injury not requiring LOC. Additionally, SRC may come from direct/indirect blows to the head, neck, or body.	The document does not focus extensively on prevention measures but emphasizes the importance of education and recognition.	**Sideline Care Key Principles**: • Athletes suspected of SRC must be immediately removed from play, with checks for neck injury completed before moving the athlete. • LOC, severe or worsening headache, neck pain, repeated vomiting, unusual behaviour, or visible skull deformity are red flags that indicate emergent medical attention. • Diagnosis must be confirmed or excluded by a qualified MP. • Athletes must not RTP on the same day as the suspected SRC.	**Recovery and Treatment**: • Physical and cognitive rest for 24-48 hours • Gradual reintroduction of activity under professional guidance with early aerobic exercise (not worsening symptoms) considered beneficial during recovery. Minimum of 24 hours between stages. **Graduated RTS Protocol**: • Stage 1: Relative rest with light daily activities. • Stage 2 (Day 2-13): Gradual introduction of light physical and cognitive activities. • Stage 3: Increased tolerance for mental and physical activities.	• Type of Evidence - SRC Guideline: *ACC CIS Guideline* • Recommends specialised SRC services as a part of care, or to be used in the case of worsening and persistent symptoms.

				• Stage 4: Return to part-time work/study and non-contact sport training. • Stage 5 (Earliest Day 14): Full return to work/school and sport-specific training (requires being symptom-free). • Stage 6 (Earliest Day 21): Full return to competition, with medical clearance.	
Sport Singapore, 2019 [82]	SRC is a brain injury caused by a direct blow to the head, face, or neck, or impulsive forces transmitted to the head, ultimately changing how cells in the brain operate. This can result from collisions, falling, or other reasons.	Education and awareness of stakeholders is crucial preventative measure. Additional measures include safe practices such as appropriate equipment and rule adherence.	**Sideline Care Key Steps**: • Remove immediately from play after any bump or blow to the head, even if symptoms are mild. Look for changes (i.e. behaviour, thinking, physical functioning) Athlete must be assessed by HCP with SRC experience. • Allow RTP only with medical clearance following a GRTP protocol.	**Graduated RTP Protocol**: • Minimum one week of physical rest, followed by medical clearance, which includes 24 hours of cognitive/physical rest, followed by relative rest within the week. Gradual reintroduction of activity under medical supervision. Specific GRTP steps are not specified. • Continued recovery progress must be monitored as athlete completes structured RTP plan.	• Type of Evidence - SRC Guide: *Sport Singapore* • Briefly mentions risk of SIS and potential severity of consequences.

SRC South Africa, 2025 [51]	SRC is an injury to the brain resulting from forces (direct or indirect) to the body or head that leads to disturbances in brain function. The MOI can include general collisions, direct head strikes, or whip-lash type movements.	This web source behaves as an education platform for relevant stakeholders and HCP. Prevention measures include equipment use, rule enforcement, and updated education.	• SRC should be suspected in any event of collision or injury.
			• Suspected SRC should be removed from play immediately and assessed by a HCP experienced in SRC management.
			• Immediate management includes simple neuropsychological testing such as the Maddock's questions, with emphasis on medical assessment as soon as possible.
				Follow-Up Management:
				• RTP decisions must be individualised per player and clearance is required by MP.
				• Stepwise RTP process is outlined as:
				  ○ No activity/Complete rest until asymptomatic
				  ○ Testing parameters return to baseline pre-season
				  ○ Completion of exercise rehabilitation programme (light aerobic exercise, sport specific training, non-contact drills, full-contact practice, game play).
					• All definitions and practices have been taken from the Sports Concussion South Africa website. It is a comprehensive resource and education platform for information on SRC.
					• The South African Rugby Football Union guidelines use "If in doubt, sit them out"
					• Web source: *SRC South Africa*

CDC, 2025 [108]	SRC are brain injuries (TBI) caused by a bump/hit/jolt to the head or body, leading the brain to suddenly move, and causing chemical changes and/or damage to the brain cells.	Training modules available for HCP to further education efforts. Equipment use and rule changes are mentioned.	• Any athlete suspected of having a SRC must be removed from play immediately. Seek medical evaluation if suspicious. • Resource includes general principles of SRC care (i.e. use of ACE tools), but lacks detailed steps for sideline evaluation.	• CDC Heads Up does not specify stepwise breakdown of GRTP, or clarify timeframes- instead refers to HCP for clearance and approval of RTP. • Six step GRTP follows CISG suggestions: moving from a return to normal activities, progressing through light aerobic, moderate, heavy, and practice activities, until a full RTP to competition level. • Persistent symptoms should be monitored and referred to specialists if symptoms continue beyond expected recovery timelines.	• Type of Evidence - Web source: *USA Government CDC* • Simple web resource designed to support HCP in delivering care for SRC.
FiA, 2024 [135]	SRC is a mild brain injury that results from either a direct hit to the head, rapid deceleration, or impact elsewhere on the body. Signs and symptoms vary.	Document does not explicitly detail specific preventative strategies.	• Competitors who suspect SRC are required to present *themselves* to the medical team for assessment. • HCP will assess symptoms and confirm or rule out SRC. Diagnosed SRC athletes must sit out for the remainder of the event. •	• The document lacks detailed clinical follow-up or prognosis information.	• Type of Evidence - Concussion educational program: *FIA* • "If in doubt, sit out."
Motorsport Australia, 2020 [151]	The document does not explicitly define SRC.	Limited mention of preventative measures but briefly focuses on adherence	• Immediate focus is on ruling out trauma, cervical, or other life-threatening injuries.	• Reintegration back (after deliberate rest for 24-48 hours) to competition follows stepwise approach suggested by AIS (Concussion in sport Australia).	• Type of Evidence - Concussion guidelines: *Confederation of Australian Motor Sport (Motorsport Australia)*

		to guidelines and timely symptom reporting.	• SRC tools (i.e. SCAT 5, CRT5, Maddock's) recommended for initial assessment. • If cleared after assessment, they can be released. If potentially concussed, competing is not allowed for 48 hours.	• Graded levels of exercise are suggested but are personalised per athlete under HCP supervision (generally following progression from light aerobic exercise to full return to full contact training). • Medical assessment results must be submitted to Motorsport Australia for license reinstatement. • Competitors with multiple SRC within a season require specialist HCP review before returning.	• Motorsport Australia is a member of the FIA, therefore adopts similar policies. It also follows AIS. • "If in doubt, sit them out"

CASC Ontario, 2021 [132]	No formal definition of SRC is provided.	Emphasizes the use of safety devices such as competition-approved helmets, seatbelts, and roll bars/cages to reduce injury risk.	• Competitors must report after incidents causing significant vehicle damage.
			• HCP use tools (i.e. SCAT5) to assess symptoms and prioritise 'red flag' symptoms.
				• Competitors are instructed to rest until all symptoms resolve before beginning light exercises under medical guidance.
				• A graduated protocol involving:
				  ○ Light exercises as prescribed by a MP.
				  ○ Gradual RTS starting with practice sessions at lower speeds/intensities.
				  ○ Full clearance only after competitors can perform competitive activities for 30 minutes without symptoms.
				• Requires medical clearance from a practitioner before resuming racing.
					• Type of Evidence - Concussion protocol, *CASC Ontario*
					• Protocol steps are adapted from *2017 Berlin CISG statement.*

MNZ, 2022 [68]	SRC is a mTBI that involves a complex pathophysiological process affecting the brain due to biomechanical forces (i.e. direct impact or indirect forces) causing sudden acceleration/deceleration of the brain within the skull. Symptoms range from confusion and memory loss to severe cases of amnesia or unconsciousness (i.e. LOC not required for it to be SRC).	Education for rider/stakeholders to recognise symptoms and report. Highlights the importance of helmets, headgear, and other protective devices.	• Recommends tools (e.g. ACC) for quick sideline assessment, with referral to appropriate MP. No specific sideline steps are given within this guideline.	• Rider is required to be immediately removed, followed by close monitoring. **Stepwise Process**: • Rest for 2 days (i.e. complete mental and physical rest) • Light Aerobic Exercise**:** 14 days of symptom-guided movement • Sport-Specific Exercise**:** Light running or speed work • Progressive Training**:** Complex drills, weight training • Full Training**:** After clearance, riders can resume full practice sessions for 2 days. • RTP: After progression through all stages and an additional 1-day recovery period.	• Type of Evidence - Concussion guideline, *Motorcycling NZ* • Recommends using tools and resources produced by the ACC. • Reinforces the risks of returning to activity prematurely (SIS risk).
Motorsport UK, 2024 [136]	This policy describes symptoms of SRC, with no explicit definition provided.	The document does not explicitly address preventative measures beyond mentioning early recognition and proper management of SRC.	This document does not specify tools, resources, or protocols for sideline evaluation. The athlete must be assessed by the CMO (or equivalent HCP) for any decisions.	• License suspension for a minimum of 21 days post-incident. • Medical clearance from a GP or a licensed HCP needed. • Specialist evaluation is recommended for persistent symptoms or complex cases.	• Type of Evidence - Concussion policy, *Motorsport UK* • SCAT6 is recommended as an additional tool for SRC management.
Baseball Canada, 2019 [99]	The document does not explicitly define SRC.	Annual pre-season education and awareness of stakeholders is important preventative measure. Additional measures include mandatory pre-season documentation prior to activity (i.e. education sheets).	○ Recognition of SRC begins with stakeholders who are all responsible for identifying and reporting suspected SRC. Immediate emergency medical attention must be sought out if 'red flag' symptoms are seen. ○ HCP should use tools (i.e. CRT5, SCAT5) to assess SRC. Medical assessment and	RTP includes a stepwise progression, with a minimum of 24 hours between stages: 1. Symptom-limiting activity**:** Gradual reintroduction of activities. 2. Light aerobic activity**:** Slow-paced exercises. 3. Baseball-specific exercise**:** Running drills, low-intensity baseball drills.	• Type of Evidence - Concussion protocol, *Baseball Canada* • This document emphasises medical documentation alongside each step, including prevention and management. A standardized 'Medical Clearance Letter' must be provided by a HCP before RTP of baseball activities.

			documentation (i.e. assessment letters) are heavily emphasized. ○ Participants diagnosed with a SRC must not RTP until medically cleared.	4. Non-contact training drills**:** High-intensity baseball drills and resistance training. 5. Full practice**:** Full participation in practices. 6. Return to baseball**:** Full game play following medical clearance.	
Basketball Australia, 2024 **(59)**	SRC is described as a TBI induced by biomechanical forces to the head or body, causing short-lived neurological impairment.	BA encourages preseason education and baseline assessment, alongside regular monitoring throughout the season (i.e. SCAT6).	○ Trained HCP are encouraged to use evaluation tools (e.g. SCAT6, CRT6). ○ Players with suspected or confirmed SRC must be removed from play immediately and assessed by a HCP/MP. Players must not RTP on the same day as the injury if SRC is confirmed. ○ Evaluation and assessment should be performed in a quiet area. ○ Thorough medical and emergency evaluations must be completed especially in cases of serious injury (i.e. red flags, cervical injury).	○ Mandatory relative rest for 24-48 hours post-injury. ○ Following rest, a GRTP protocol begins with minimum of 24 hours required for each stage: ○ Light-moderate aerobic activity ○ Simple basketball skills ○ Full-intensity training without contact (e.g., limited drills). ○ Full training, including contact, after medical clearance. ○ RTP following final medical clearance (i.e. return/exceed preseason baseline). ○ Complex cases require referral to specialists.	• Type of Evidence - Concussion guidelines, *Basketball Australia* • This resource references the CISG consensus statement as well as the Australia Sport position statement.
Canada Basketball, 2019 **(76)**	SRC is described as a TBI caused by biomechanical forces. This can result from indirect or direct blows to the head, neck, or body, causing a rapid onset of short-lived neurological impairment.	Risk reduction and prevention efforts includes the sharing of SRC histories with stakeholders for personalized management.	○ Clinical diagnosis is solely dependent on registered HCP/MP. ○ Initial sideline actions include recognition of red flags (e.g. neck injury), and observation of common SRC signs. ○ Evaluation tools (e.g. SCAT5) are recommended, with later medical evaluation. ○ Athlete should be immediately removed if there are signs or suspicions of SRC.	○ Initial rest of 24-48 hours, avoiding strenuous activity or mental exertion. ○ RTP protocol requires 24 hours minimum at each stage, with regressions if appropriate: ○ Stage 1**:** Symptom-limiting activities. ○ Stage 2**:** Light aerobic exercises. ○ Stage 3**:** Sport-specific exercises. ○ Stage 4**:** Non-contact training drills. ○ Stage 5**:** Full-contact practice after medical clearance. ○ Stage 6**:** Full RTS. ○ Important to monitor long-term (i.e. emotional and cognitive changes following SRC event).	• Type of Evidence - Concussion policy, *Canada Basketball* • This policy document was approved in 2019. Information given within the policy is adopted from the *2017 Berlin CISG statement* (i.e. structured with 11R's). • Canada basketball has a website for up-to-date SRC resources that refers to Parachute Canada's SRC guidelines.
Basketball England, 2016 **(107)**	SRC is defined as a pathophysiological process impacting the brain, which are induced by biomechanical forces**.** This injury can be caused by direct/indirect forces to the head, resulting in rapid onset of short-lived brain function impairments.	The document does not explicitly address preventative measures.	**Sideline Information** ○ Players showing signs or symptoms of SRC must be immediately removed from play ("If in doubt, sit them out"). ○ SCAT3 is recommended as an evaluation tool. ○ Immediate medical attention is required for worsening symptoms or observation of 'red flags' (e.g. LOC, convulsions). ○ Immediate steps include removal of the player from play immediately and rest. Players must not RTP or training on the same day as the suspected SRC. All final decisions are to be made by a physician and/or HCP.	**Protocol of GRTP** ○ The GRTP contains six distinct stages (24 hour minimum), even for the enhanced care setting. This includes: ○ A recommended rest period (minimum 24 hours) ○ Four stages of training based on increasing monitored activity. ○ A final full RTP and return to competition stage. ○ MP must review and agree for player to move through GRTP. Enhanced care setting means this GRTP can be shortened. ○ Emphasises collaborative care for persistent and/or prolonged symptoms.	○ Type of Evidence - Concussion guidelines, *Basketball England* ○ This document represents guidelines for Basketball England, Basketball Scotland, Basketball Wales, and British Basketball. This is the most updated document on the Basketball England web resource page. ○ This document reflects and adopts findings from the *2012 CISG statement.*

AIBA, 2020 [152]	The document does not explicitly define SRC but provides criteria for identifying potential head injuries and related symptoms.	The document does not discuss specific preventative measures for SRC.	**Evaluations and Sideline Information** ○ Boxers must pass a pre-bout medical check to be cleared for competition (i.e. physical assessments like gait, vision, balance, nerve function). Post-bout examinations are also mandatory for all boxers (including head injury checks and SRC signs). ○ If SRC is suspected, boxer should be removed and evaluated by HCP immediately. A concussed boxer is not permitted to return to play prior to the mandatory rest period and medical clearance (subject to change per case). ○ A bout should be stopped if a boxer is demonstrating signs of SRC, and a ringside doctor must evaluate the athlete (i.e. movement, pupils, cranial nerve weakness, responsiveness, balance) using tools (e.g. SCAT3, BESS).	**Suspension and RTP** ○ Unresolved SRC symptoms sanction disqualification and a declaration an athlete is unfit for competition. Post-bout medical evaluation forms must include suspension periods and injury details. ○ Minimum 30 days for KO due to head blows. Suspensions may be longer (3-12 months) for LOC or multiple KO incidents. ○ No specific GRTP stages are outlined in the document, but clearance after rest and symptom resolution is mandatory. Medical clearance and potential neurologist's evaluation (with imaging), is required before RTS.	○ Type of Evidence - Medical Handbook, *AIBA* ○ The document targets ringside doctors, HCP, and MP. Meant to provides medical protocols for ringside doctors to manage several injuries, including SRC, during boxing competitions.
Boxing Canada, 2020 [153]	The document does not explicitly define SRC but provides a list of symptoms indicative of a potential SRC (e.g. headache, dizziness, confusion, fatigue, light/noise sensitivity).	The protocol does not discuss preventative measures for SRC.	This document does not specify tools, resources, or protocols for sideline evaluation. The athlete must be assessed by a HCP for any decisions and completion of a medical assessment letter.	**SRC Management** ○ Initial management includes 24-48 hours of complete rest. ○ RTP protocol contains six phases broken up into sub-phases. Generally, it includes: ○ Symptom-limited activity ○ Light aerobic exercise ○ Sport-specific exercise ○ Non-contact training drills ○ Full-contact practice ○ Competition return ○ A minimum of a 30-day period is recommended prior to the fifth phase (i.e. sparring).	• Type of Evidence - Concussion protocol, *Boxing Canada & Institut National Du Sport Du Quebec*
ICC, 2024 [72]	SRC definition is directly referencing *the 2022 Amsterdam CISG statement*. It describes SRC as a TBI caused by direct or indirect blows, with resulting metabolic, neurological, and/or cognitive changes. It emphasizes that symptoms may develop over time and are not detectable through standard imaging.	The document provides moderate preventative strategies. Awareness and education are emphasized for players, coaches, and support staff. However, the document does not include environmental or equipment-based prevention strategies (e.g. helmet technology or rule changes) beyond general awareness. The ICC allows teams to substitute a concussed player during international matches.	**Sideline Evaluations and Diagnosis** ○ Players suspected of SRC must be immediately removed from play and undergo off-field assessment (e.g. SCAT6). In most cases, players cannot RTP in the same game unless the diagnosis is reversed (i.e. medically clearance) by an MP. If SRC is not diagnosed, the player may resume play with regular monitoring. ○ On-field assessments should include general questions for the player, evaluation of signs/symptoms (e.g. responses, dazed, Maddocks) and video surveillance if appropriate. ○ Players with suspected severe brain injury (e.g., convulsions, focal neurological	**SRC Management & Rehabilitation** ○ Following *2022 Amsterdam CISG statement* recommendations, the GRTP process includes 24 hours of relative rest, followed by movement through phases with no symptom return. Typical GRTP progression moves through light aerobic exercise, light training, full training, and clearance to RTP. ○ RTP decisions are based on medical clearance. **Prolonged Symptoms** ○ Players with delayed symptoms up to 48 hours require repeated assessments (i.e. SCAT6 and medical monitoring). ○ MRI and neuropsychological testing might be necessary for players with persistent symptoms or repeated SRCs.	• Type of Evidence - Concussion guidelines, *ICC* • This document follows guidance from the *2022 Amsterdam CISG statement.* • Intended for elite-level sports physicians, physiotherapists, and healthcare teams across men's and women's cricket globally.

			deficits) must be urgently transferred for medical attention.		
Cricket Australia, 2020 [125]	The document does not explicitly define SRC.	Protective equipment requirements are listed within this document- recommending using ICC-compliant helmets and additional neck guards. The ICC allows teams to substitute a concussed player.	**Sideline Management** • The highest qualified MP should enter the playing field immediately, and SRC diagnosis is established through symptom/sign observation and reporting. • Players with suspected SRC are immediately removed from play for further assessment (using SCAT5 and CogSport), and video footage is used to identify obvious head impact.	**Return to Play** • Players must not RTP on same day of SRC diagnosis. Staged PA must not occur until after a 24-hour period. Players cannot return for training or RTP until medically cleared. • There are no outlined steps for the progression of RTP activities within this document. The stages of activity must be prescribed and monitored by an appropriate HCP.	• Type of Evidence - Concussion policy, *Cricket Australia* • This document refers to the *2017 Berlin CISG statement*, the Sport Australia Position Statement, and the ICC SRC guidelines for further information.
UCI, 2024 [137]	The document does not provide an explicit definition of SRC.	The document does not address preventative measures for SRC. The UCI recommends the use of pre-season baseline evaluation.	**Sideline Management** o If they have enough time (10 mins), physicians must use the SCAT5 for detailed assessments. o Riders with confirmed SRC must be immediately removed from competition or training. All confirmed SRCs must be reported to the UCI Medical Director within 24 hours using an official form.	**Return to Competition Guidelines** o Adult riders must wait a minimum recovery period of 7 days following SRC diagnosis. o Riders must complete all stages of recovery and receive medical clearance before RTS.	• Type of Evidence - Concussion information, *UCI*
AusCycling, 2025 [83]	SRC is a brain injury resulting in brain function disturbance. It may present itself differently amongst individuals.	This source provides links to SRC education courses for HCP to learn up-to-date information on treatment and management.	**Sideline Management** o If SRC is suspected, the rider should be immediately removed from activity. The "if in doubt, sit them out" is used. o Assessment tools (e.g. SCAT6, CRT6) are recommended. HCP is required to evaluate and diagnose athlete. o If determination of SRC is inconclusive, the athlete may not return prior to medical assessment being completed. If SRC is not determined, they may not return earlier than 24 hours after incident.	**Return to Cycling** • A rest period of 24-48 hours is recommended immediately after incident. • A GRTP sport framework flow chart is provided. The athlete must progress from light aerobic exercise, to return to full capacity work. • Minimum of 14 days without SRC symptoms required before return to training. Minimum of 21 days prior to competition return.	• This web source provides a structured approach for the assessment, management, and return-to-cycling process following an SRC. This resource is designed for riders, stakeholders, and HCP. • This web source references and adopts information from the Australian government and UCI SRC guidelines.

Cycling Canada, 2020 [73]	SRC is a form of TBI induced by biomechanical forces. Common diagnostic features include the MOI (e.g., direct or indirect blows to the head) and symptomatology, such as functional disturbances and cognitive changes.	Recommends pre-season baseline testing using SCAT5, neurocognitive tools, and balance testing.	**Sideline Evaluation**
			o Any athlete showing signs/symptoms of SRC after impact must be removed from activity immediately.
			o Athlete must be medically assessed and transported if emergent medical attention is needed.
			o Full rest is recommended, with no same-day RTS following suspected SRC.
				Management Strategy
				o Athletes are advised to rest before beginning gradual rehabilitation.
				o Once RTS steps begin, athlete must remain asymptomatic and have a 24-hour minimum prior to stage progression. RTS strategy can be individualised based off these guidelines.
				  o Symptom-limited activity.
				  o Light aerobic exercise.
				  o Sport-specific training (low intensity).
				  o Training drills/resistance training.
				  o Regular training and skills.
				  o Full readiness to return.
				o Specialized rehabilitation is recommended on an individual bases.
					• Type of Evidence - Concussion protocol, *Cycling Cyclisme Canada*
					• This guideline was created based off of the *2017 Berlin CISG statement*, Parachute Canada, and COPSI guidelines.
					• Developed by the Members Cycling Canada Medical Team.

Federation Equestre Internationale, 2023 [117]	SRC is a TBI caused by biomechanical forces transmitted to the brain, often resulting from a hit to the head or body, which interferes with regular brain function.	No explicit preventative measures mentioned in the document.	**Sideline Evaluation** ○ Athletes with suspected SRC must be immediately removed from activity and evaluated by a MP. If no trained HCP are available, the athlete should be transported to a hospital for further assessment. ○ Policy includes a flow chart outlining the SRC processes at FEI events, including copies of SCAT5 (inclusive of on-field assessment, Maddocks questions, and additional examinations).	**Stages of Return to Riding** ○ The athlete must begin with rest, but there is no established timeframe. RTP steps cannot begin until the athlete is asymptomatic. ○ Rest (no timeframe) ○ Light aerobic training ○ Sport-specific exercise ○ Increase in training intensity ○ Full training (asymptomatic) ○ Back to competition ○ A SRC RTP Form must be completed and submitted to the FEI by an appropriate HCP.	• Type of Evidence - Concussion policy, *Federation Equestre Internationale (FEI)* • This SRC policy document is coupled with an online web source for additional resources.
Equestrian Australia, 2021 [122]	SRC is classified as a mTBI involving short-term neurological impairment. This results from direct or indirect impacts to the head or body, where an impulsive force is transmitted to the brain.	The document does not explicitly discuss preventative measures; however, educational material is provided to MP and stakeholders to enhance awareness and management.	○ A suspected or confirmed SRC means the rider is required to rest and is unable to continue riding. All decisions regarding SRC diagnoses are given by MP. ○ Assessment tools (e.g. SCAT5) are required to properly record SRC signs/symptoms (for HCP). ○ SRC reporting is mandatory and thorough.	○ SRC cases are reported and monitored closely. Athletes cannot ride, train, compete, or complete activities while listed as concussed (on records). **GRTP Protocol** ○ Complete cognitive and physical rest. ○ Light aerobic activity. ○ Equestrian-specific exercises. ○ Gradual increase in training intensity. ○ Full training after medical clearance. ○ Return to competition. ○ Athletes must remain symptom-free for at least 24 hours at each stage before progressing.	• Type of Evidence - Concussion information, *Equestrian Australia* • This resource aligns with *Australia's Concussion Position Statement* and incorporates recommendations from the FEI.
Equestrian Canada, 2020 [74]	SRC is a TBI induced by biomechanical forces, caused by direct/direct blow to head, neck, or body with forces transmitted to the head. Additional common features such as clinical symptoms and neuropathological changes are listed within the document definition.	This document encourages education on SRC recognition and management. It also enforces the use of safety equipment and gathering clinical history for athletes. All SRC incidents must be logged using Equestrian Canada's forms and records.	○ Athletes with suspected SRC must be immediately removed from participation and referred for medical assessment using SCAT5. ○ The resource provides several lists of symptoms, observable signs, memory questions, and red flags. ○ Athletes with a suspected SRC are removed and are told to isolate in a dark room with minimal stimulus, be monitored, and are restricted from certain activities (e.g. no alcohol, driving, etc.).	**SRC Management** ○ A rest period of 24-48 hours is recommended, avoiding vigorous physical or cognitive activities. Gradual reintroduction of activities is recommended, ensuring symptoms do not worsen. ○ A six step GRTP protocol is provided, moving from symptom-limited activity, moving through to competition. Medical clearance must be obtained prior to full training (i.e. step 5), and proceeding to competition (i.e. step 6). ○ Each step should be at least 24 hours or longer, guided and approved by HCP.	• Type of Evidence - Concussion policy, *Equestrian Canada Equestre* • This document uses *2017 Berlin CISG statement* recommendations for management practices. • Residual effects and prolonged management are briefly discussed within the document. Participants are made to be aware of these potential long-term problems.
Equestrian Sports New Zealand, 2024 [87]	SRC is a mTBI caused by direct or indirect biomechanical forces transmitted to the brain. It results in a functional disturbance, often presenting with varying symptoms (e.g. headache, dizziness) and typically resolves quickly.	While the document emphasizes education of SRC, specific prevention strategies are not detailed. Helmet use is required during riding.	**Evaluation Tools & Action** ○ Riders with suspected SRC must be removed from activity immediately. No rider should RTS on day of suspected or confirmed SRC. ○ Recommends CRT6 for non-medical personnel and SCAT6 for HCP. All suspected SRC cases must be assessed by a qualified MP. If red flags are present (e.g., severe headache, vomiting), urgent medical help is required.	**SRC Management** ○ 48 hours of cognitive/physical rest is mandatory (i.e. stage one). Once medically cleared to begin, rider should then initiate GRTP (return to riding) programme. This should be done under HCP supervision. ○ Stage 2-4 in a graduated RTP programme as part of a medical supervised treatment plan. ○ Stage 5 is a return to full training. It is dependent on full-time return to ADL,	• Type of Evidence - Concussion policy: *Equestrian Sports New Zealand (87)* • ESNZ adopts the *2022 Amsterdam CISG statement* and the ACC National SRC guidance.

				symptom-free for 14 days minimum, and completion of stages 1-4. ○ Rider may return to competition after a minimum of 21 days post-injury, with strong recommendation for medical clearance. ○ Persistent symptoms (beyond 4 weeks) require referral to a specialist.	
Medical Equestrian Association Ireland, 2016 **(129)**	SRC is a brain injury caused by a blow/hit/biomechanical forced to the head or body transmitted to the brain. LOC is not required, however symptoms range in type and severity.	No preventative measures mentioned in the document.	**Sideline Information** ○ Rider should be removed from activity immediately. Maddocks questions are recommended as a tool within sideline assessment. If rider is assessed as SRC negative, they may return to riding. ○ Refer to hospital or medical care if symptoms worsen or do not improve (i.e. re-assess condition).	**SRC Management** ○ Riders must not ride or engage in physical activities on the day of the injury. Complete cognitive and physical rest is mandatory until symptoms resolve. ○ Stages of RTP may begin once asymptomatic. Rider must progress through to competition-ready phase without symptom exacerbation.	• Type of Evidence - Concussion summary, *Horse Sport Ireland*
British Equestrian, 2023 **(90)**	SRC is defined as an injury to the brain resulting in a disturbance of brain function**,** caused by a direct or indirect blow to the head or body (i.e. whiplash-type motion).	No preventative measures mentioned in the document.	**Sideline Evaluations and Diagnosis** ○ Recommends using the CRT5 for initial assessments. ○ Riders with suspected SRC must be removed from activity. ○ The document emphasises awareness of red flags requiring emergency care (e.g. neck pain, worsening headache, seizures, LOC). ○ No mention or emphasis on medical diagnosis or referral.	**SRC Management** ○ Rest should be advised for the 48-72 hours following the incident. Light PA can begin after the 48–72-hour period. GRTP process can begin once athlete is back to ADL (e.g. work, school). ○ The return-to-ride protocol begins with light physical activity and progresses to sport-specific exercises and non-contact drills. ○ Full practice and competition are permitted only after completing the protocol, with a minimum of 21 days post-injury. Riders must return to an earlier stage if symptoms recur.	• Type of Evidence - Concussion guidelines, *British Equestrian Federation* • This document refers to the *2017 Berlin CISG statement* and FEI guidelines for further resources. • This guideline provides specifications for riders within an advanced care setting. This allows an accelerated RTS for symptom-free individuals under close medical supervision, incorporating baseline and serial SCAT assessments.
US Equestrian, 2025 **(113)**	No specific definition for SRC is provided in the web source, but it references the 2022 CISG statement definition.	Educational material and resources are provided.	**SRC Recognition** ○ This web source does not provide specific sideline evaluation steps or detailed components. Instead, it recommends assessments like SCAT6 and provides links to access these tools if needed.	**Equestrian Specific RTS Strategy** ○ The RTS strategy is linked as a resource through this web source. It provides a six-stage process for a gradual return to full competition. ○ Riders begin with symptom-limited daily activities, progress through light aerobic exercise and sport-specific tasks, and eventually resume full-contact training and competition. ○ Each stage requires a minimum of 1–2 symptom-free days before progression, with medical clearance mandated prior to returning to competition.	• This web source includes references to the *2022 Amsterdam CISG statement,* CDC concussion information, and educational courses for MP and stakeholders. • Rather than offering a comprehensive guideline, the source aggregates various resources and materials related to SRC management.
Hockey Australia, 2024 **(60)**	SRC is a TBI caused by direct or indirect forces to the brain (i.e. blow to the head or whiplash). It is characterized by neurological	Encourages the use of protective equipment (e.g., helmets, face masks) to reduce head injuries.	**SRC Recognition and Removal** ○ Players showing signs (e.g. LOC, incoordination, disorientation) of SRC must be removed from play immediately.	**SRC Management** ○ A relative rest period of 24–48 hours is required, avoiding both physical and cognitive activities.	• Type of Evidence - Concussion policy, *Hockey Australia*

	impairments, including symptoms like headache, dizziness, and memory loss, which may evolve over time, requiring close monitoring and medical evaluation.		○ Recommends SCAT6 for medical evaluations and allows referral to previously taken assessments as baseline (for high-performance athletes). ○ Referral to a MP with SRC experience is required for all players with a suspected SRC. ○ All suspected SRCs must be documented and reported using the Hockey Australia online concussion report form.	○ Graded RTP programme is broken into three steps. Following relative rest (step one), the athlete should participate in a gradual reintroduction of normal ADL (step two) and then begin a gradual return to full activity (step three) with monitoring. ○ The guideline provides a GRTP schedule (minimum process) but emphasizes allowing a longer recovery timeline if needed. If symptoms recur, the athlete must regress to the previous stage and consult a medical professional. ○ Players must remain symptom-free at rest for at least 14 days before full-contact activities. ○ Persistent symptoms beyond 21 days require referral to a specialist, such as a neurologist or sports MP.	• Aligns with the *2022 Amsterdam CISG statement* and Australia Sport guidelines. • "If in doubt, sit them out!"
Field Hockey Canada, 2021 [94]	SRC is a brain injury that cannot be detected on x-rays or scans and affects how an athlete thinks, often causing various symptoms. It results from a blow to the head, face, neck, or body that jars the head, with symptoms potentially appearing immediately or within 24-48 hours. This definition is given on their 'pre-season concussion education sheet'. It uses information provided by Parachute Canada.	This protocol emphasises the impact education has on recognition and management of SRC.	**SRC Suspicion/Recognition** ○ Any athletes with suspected SRC should be immediately removed from play. They cannot RTS during the same game or practice. ○ All suspected SRC must be medically assessed (i.e. by HCP, MP) and be recorded with medical clearance to RTP. ○ Assessment tools (e.g. CRT5, SCAT5) must be used as an aid for SRC signs/symptoms. Medical diagnosis from MP is required.	**SRC Staged Return Process** ○ The guideline outlines RTS and return-to-school processes, starting with an initial rest period of 24–48 hours (cognitive and physical) before beginning activity. ○ Athlete begins with ADLs that do not provoke symptoms, focusing on symptom monitoring. ○ Gradually introduce light aerobic activity without resistance training, aiming to increase heart rate. ○ Progress to sport-specific exercises. ○ Advance to non-contact training drills. Medical clearance is required before resuming full-contact practice. ○ The final stage is a full return to normal gameplay (RTS).	• Type of Evidence - Concussion protocol/policy, *Field Hockey Canada* via web source. • The complete SRC management protocol is partnered with a web source that provides additional information (i.e. pre-season information, important definitions, assessment resources, educational material).
GB & England Hockey, 2020 [96]	SRC is a mTBI caused by direct or indirect forces to the head, leading to a temporary disturbance in brain function (e.g., memory problems, balance issues, etc.).	No preventative measures mentioned in the document.	**Sideline Information** ○ Players with suspected SRC must be immediately removed from play and referred to a HCP. They are unable to return the same day. ○ If red flags (e.g., convulsions, LOC) are present, emergency care is required. ○ Pocket CRT, SCAT5, and clinical assessments by HCP are recommended. These assessments may aid appropriate MP in finding SRC diagnosis (i.e. diagnosis is supported by tools like these).	**SRC Management** ○ A minimum rest period of 24 hours for adults is required before starting rehabilitation and GRTP (14 days for players under 18 years). ○ Athletes must wait a minimum of six days to return to competition after injury (if over 18 years). GRTP timeline and minimum return time is extended for younger athletes. ○ Commencement and progression of GRTP must be guided by qualified HCP. ○ GRT protocol (stepwise progression) begins after an initial rest period. Players gradually reintroduce activities, starting with light aerobic exercise, followed by sport-specific drills, non-contact training, and full-contact practice once medical clearance is obtained.	• Type of Evidence - Concussion policy, *England Hockey* • This policy aligns with and references the *2017 Berlin CISG statement*. • This policy addresses recurrent or complex SRC cases, recommending specialist evaluation and a conservative GRTP timeline for players with multiple SRCs or prolonged recovery. It also highlights various factors (e.g., signs, medications, behaviour) for additional monitoring to ensure a safe return to activity.

				○ The final stage is a full RTP, with each stage requiring a minimum of 24 hours (for adults), if they remain symptom-free. If symptoms recur, the player must revert to the previous stage.	
Football Australia, 2019 **(127)**	This policy uses the *2017 Berlin CISG statement*: SRC is a TBI caused by biomechanical forces, such as direct or indirect blows to the head, face, neck, or body. It reflects functional, not structural, injury and may not appear on neuroimaging.	The policy emphasizes education and adherence to protocols but does not include specific preventative strategies.	**Sideline Information** ○ Players with suspected SRC must be removed from play immediately and cannot RTP the same day. Diagnosis must be made by a qualified MP. ○ Recommends the SCAT5 and the Pocket CRT for sideline and off-field assessment. ○ The policy outlines specific laws and procedural requirements to follow an SRC incident, ensuring compliance and proper documentation.	**SRC Management** ○ There is a mandatory rest period of 24–48 hours for adults (minimum of 14 days for children and adolescents) where the athlete should avoid physical and cognitive activities. ○ GRTP protocol involves six stages, beginning with total rest and symptom monitoring. Players progress through light aerobic activity, sport-specific drills, non-contact training, and full-contact practice (with medical clearance) before returning to competition. ○ Each stage requires 24 hours for adults (48 hours for children/adolescents), with players reverting to the previous stage if symptoms recur. ○ A declaration signed by a MP is required before players are permitted to return to competition.	• Type of Evidence - Concussion policy, *Football Federation Australia* • This policy was produced in conjunction with the FIFA policy.
Canada Soccer, 2018 **(102)**	A SRC is a brain injury that disrupts brain function, affecting thinking and behaviour. It is caused by a direct blow to the head or a body impact that results in rapid head movement. Symptoms typically appear immediately but can evolve within 24–48 hours.	The policy emphasizes education but does not include specific preventative strategies.	**Sideline Evaluation + Diagnosis** ○ Sideline recognition of SRC is critical. The policy highlights the importance of identifying observable signs and recognising symptoms to ensure appropriate management. ○ Players with suspected SRC must be removed from play immediately and referred to a MP. ○ CRT5 is recommended as a tool for assessment. ○ Disclosure and reporting of SRC symptoms are emphasised. Clubs must use *Canada Soccer's Concussion Assessment Medical Reports* to track and manage player recovery.	**Recovery + RTP** ○ A rest period of 24–48 hours is required to avoid physical and cognitive activities that worsen symptoms. ○ Progression between stages requires symptom-free completion, with a minimum of 24 hours per stage (longer for children). Recurrence of symptoms requires a return to the previous stage. ○ Players follow a stepwise RTP strategy after rest, progressing through symptom-limited activities, light exercise, soccer-specific drills, and non-contact training before full-contact practice and competition, with medical clearance required at key stages.	• Type of Evidence - Concussion policy, *Canada Soccer Sports Medicine Committee* • "If in doubt, sit them out" • The policy underscores the risks of prolonged symptoms and inadequate SRC management, advising that players with repeated SRCs or delayed recovery be evaluated by a multidisciplinary team, with re-evaluation and referrals prioritised when needed.
Meyer et al., 2023 **(118)**	The document does not explicitly define SRC. Instead, it discusses head injuries broadly and provides specific protocols for identifying and managing suspected SRC cases.	Mandatory baseline testing is conducted at the start of each season to establish players' functional norms. There are a few educational initiatives taken by the DFL. Annual emergency medical training is mandatory for medical staff, alongside additional workshops for stakeholders.	**Sideline Information** ○ Referees must stop play for HIA lasting up to three minutes for appropriate treatment time (longer if needed). ○ Players with suspected SRC must be removed from play if symptoms cannot be ruled out during sideline evaluations. SCAT5 is recommended as part of baseline and acute HIA. ○ Player cannot RTP if MP is suspicious of injury or SRC.	**RTS after SRC** ○ Players require physical and mental rest for at least 24–48 hours. ○ Documentation of the rest phase is required before beginning RTP protocol. This involves a staged progression of exercise, with each stage lasting a minimum of 24 hours. Players are monitored for the recurrence of symptoms (symptom recurrence requires a return to the previous step). ○ The recommended stages include: ○ Light aerobic endurance training, football-specific individual exercises with minimal	• Type of Evidence - Concussion protocol, *DFL Deutsche Fußball Liga* • The DFL includes detailed recording of SRC cases using standardized forms to ensure proper management.

			○ All relevant signs and symptoms must be recorded (medical forms provided) to aid in immediate treatment and longer-term management. Video analysis tools in the technical zone are also used to assist medical staff in reviewing injury.	cardiovascular load, and non-contact training in small groups. ○ Following medical clearance, players progress to full-contact training and participation in regular matches. ○ Additional medical clearance required for competitive play.	
NZF, 2018 [128]	Taken from the *2017 Berlin CISG statement* definition: SRC is a TBI induced by biomechanical forces.	The policy focuses on management and response rather than preventive strategies.	**Sideline Evaluations** ○ Players suspected of having an SRC must be removed from play immediately and cannot return the same day. ○ Only qualified medical doctors can diagnose SRC, using tools (e.g. SCAT5) to aid in assessments.	**SRC Management Strategies** ○ Graded RTP stages begin with no activity (physical and cognitive rest) and progress through incremental stages until full RTP. This programme should take a minimum of six days to complete before return. 24 hours should be taken as a minimum at each stage, with no symptom exacerbation. ○ Stage 1**:** Complete rest until cleared by a medical doctor. ○ Stage 2**:** Light aerobic exercise 70% heart rate. ○ Stage 3**:** Sport-specific drills without head impacts. ○ Stage 4**:** Non-contact training with progressive resistance exercises. ○ Stage 5**:** Full-contact training (medical clearance).	• Type of Evidence - Concussion policy, *New Zealand Football* • This policy is part of the NZF statutes, making it binding for all football activities in New Zealand.
Broglio et al., 2019 [77]	SRC is a TBI induced by biomechanical forces, caused by impacts to the head, face, neck, or body. SRC reflects a functional, not structural, disturbance, and does not appear on standard imaging like CT or MRI scans.	Notes potential benefits of neck strengthening, proper heading techniques, and equipment like mouthguards. Emphasizes pre-season baseline testing to establish player-specific norms.	**Sideline Information** ○ Players with suspected SRC must be removed from play and assessed by a qualified MP. ○ Recommends using the SCAT5 for clinical evaluations, and CRT5 for non-medical personnel to assist in identifying potential SRC. ○ SRC diagnosis is a clinical judgment made by a trained MP.	**SRC Management** ○ Athletes must have 24–48 hours of rest, avoiding activities that exacerbate symptoms. A six stage RTS process begins after this. ○ Each stage is minimum of 24 hours, with progression dependent on being symptom-free (or you must regress to the previous stage and rest). ○ It begins with symptom-limited daily activities and progresses through light aerobic exercise, soccer-specific non-contact drills, and non-contact training, full-contact practice and competitive play.	• Type of Evidence - Concussion guidelines, *USA Soccer* • This document discusses the role of specialists for those with prolonged symptoms or multiple SRCs.
IIHF, 2021 [148]	The document does not provide a definition of SRC.	No preventative measures are mentioned in the document.	**Acute Evaluation and Management** ○ Any player with signs (e.g. incoordination, disorientation, etc.) or reported symptoms (e.g. headache, nausea, amnesia, etc.) of SRC is to be removed immediately by medical staff. ○ Team MP carry-out SRC evaluation in a distraction-free separate environment (i.e. MP makes SRC diagnosis). ○ If player has no signs or evidence of SRC, they may RTP. If SRC is suspected or diagnosed, player cannot RTP the same day.	**RTP Stages** ○ A brief rest period (24-48 hours) is required prior to progressive re-introduction of activity. Each stage requires a 24-hour period, with no symptom exacerbation. ○ Stages begin with symptom-limited activities (re-introduction of ADL's), and progresses through light aerobic exercise, sport-specific exercise, and non-contact drills. Following medical clearance, the player may progress to full-contact practice and normal game play. ○ Team MP must approve RTP and verify normal neurocognitive function.	• Type of Evidence - Concussion protocol, *IIHF*

NZIHF, 2024 [138]	The document does not provide a definition of SRC.	No preventative measures are mentioned in the document.	**Recognition and Removal** ○ Red Flags (e.g. vomiting, seizures, neck pain, etc.) require urgent medical attention and further diagnostic testing by specialists. ○ Any player with a suspected SRC must be immediately removed from play and referred to an appropriate MP.	**SRC Recovery** ○ Players are required to stand down for SRC for a 21-day period. Medical clearance from an MP is required for player to RTP. ○ Relative rest is required for 24-48 hours (stage one), followed by a minimum of 24 hours between each stage moving forward. Days spent resting are included in the 21-day timeframe to RTP. ○ Days 2-13 include stages 2-4. This includes a gradual re-introduction of ADL, light exercise, non-contact practice and other training activities. ○ Stage 5 may begin on day 14 (earliest). This stage requires a 7-day window to ensure full re-integration of activities. ○ Stage 6 may begin on day 21 (earliest). Aiming for full RTS, athletes must obtain medical clearance and remain asymptomatic through all 6 stages.	• Type of Evidence - Concussion policy, *New Zealand Ice Hockey Federation* • This policy aligns with New Zealand national sport guidelines.
Stuart et al., 2019 [158]	It describes SRC as a TBI caused by a direct blow to the head, neck, or body. Symptoms and observable signs are detailed but without a specific overarching definition.	This document promotes education on recognising SRC signs and symptoms but does not recommend any preventative measures.	**Management Protocol** ○ Priority should go towards emergent medical issues (e.g. airway, breathing, responsiveness) prior to movement. ○ Players suspected of SRC must be removed from play immediately and not return on the same day. ○ Recommends the CRT5 and sideline assessments (e.g., memory checks) by qualified HCP. SRC must be confirmed by a HCP, and athletes should not RTP until formally cleared.	**Management** ○ Physical and cognitive rest for 24–48 hours is required (avoiding activities that worsen symptoms) following the incident. A qualified HCP should guide athletes through any RTP protocol. ○ Players progress to light aerobic exercise, followed by sport-specific activities without head impact. ○ Non-contact training with increased intensity and resistance exercises comes next, leading to full-contact practice after medical clearance. The final stage is a full return to competitive play. ○ Each stage requires at least 24 hours asymptomatic.	• Type of Evidence - Concussion protocol, *USA Hockey* • Documentation and reporting are emphasised. USA Hockey requires a standardized RTP Form signed by a HCP, parent/guardian, and coach before resuming unrestricted participation.
Banks & Eyres, 2023 [91]	SRC is defined as a disturbance in brain function caused by direct or indirect trauma to the head. It can result in a variety of signs and symptoms, with or without LOC.	Promotes education on recognising SRC and strangulation injuries for all coaches and stakeholders.	**Sideline Information** ○ Athletes with suspected SRC must be removed immediately and assessed by an HCP (e.g. SCAT5 or CRT5). Diagnosis requires evaluation by an HCP to confirm SRC and determine RTP readiness. ○ Red flags (e.g. worsening headache, seizures, or vomiting) require urgent medical attention.	**SRC Management** ○ Period of rest changes depending on level of play and age of athlete. Enhances athletes 19-years and older can be in complete rest for 24 hours (or until symptom-free), move into relative rest for 24 hours, and then proceed to the rest of the GRTP (with 24-hours at each stage). ○ GRTP starts with ADLs and light aerobic exercise before advancing to judo-specific drills, non-contact technical training, and full-contact training. Full return to competition is permitted only after medical clearance. ○ Recovery timelines are longer for athletes under 19, requiring a minimum of 23–24 days to complete. ○ Documentation, incident reports, and medical clearance are mandatory before RTP.	• Type of Evidence - Concussion protocol, *British Judo* • This policy also includes considerations for strangulation injuries (shime-waza), which can result in temporary brain injuries requiring similar management to SRC.

Karate Australia, 2024 [88]	SRC occurs when forces to the head or body transmit an impulsive force to the brain, resulting in transient neurological impairment. It is an injury with symptoms such as balance and cognitive dysfunction that may change over hours or days.	Prevention measures are not discussed. The policy focuses primarily on recognition, response, and rehabilitation. Concussion officer is required.	**Sideline Evaluation** ○ Mandatory removal from play for athletes exhibiting observable signs or symptoms of SRC (e.g., disorientation, balance issues, or confusion). Red flag symptoms require immediate emergency referral. ○ Clubs are required to report all head injuries to the State Concussion Officer.	**Return to Training and Competition** ○ Days 0–4**:** ○ Athletes must undergo 24–48 hours of cognitive and physical rest then resume ADLs if symptoms do not worsen. Begin light exercise. ○ Days 5–10**:** ○ Stationary sport-specific drills and moderate-intensity cardio exercises. ○ Days 11–15+**:** ○ Gradual reintroduction to sport-specific drills while avoiding head impact and contact activities until symptom-free. ○ Medical clearance is required for contact training and competition. There is a 21 day minimum that must pass before athletes can resume competition.	• Type of Evidence - Concussion policy, *Karate Australia* • There is included information regarding the role of concussion officers. They are required as a point of contact for SRC incidences.
WAKO, 2021 [149]	The document does not explicitly define SRC. It addresses head injuries broadly, focusing on their management during kickboxing events.	Prevention measures are not discussed. This document highlights the need for mandatory medical certificates for all participants.	○ This document explains general medical guidelines, but specific details about sideline evaluation or SRC protocols are not provided. ○ After head injury or KO, the fighter must be examined immediately by a MP. The MP will issue a "WAKO Head Injury Card", which details the required instructions for post-injury care. ○ Fighters are required to follow the instructions on the card, including obtaining brain imaging (CT or MRI scans) before they can receive a new medical certificate to resume competition.	**Return Strategies** Athletes are suspended based on the severity of the injury: ○ No LOC**:** 30-day suspension. ○ LOC under 1 minute: 90-day suspension. ○ LOC over 1 minute**:** 180-day suspension. ○ Athletes who experience two head traumas within three months are suspended for a minimum of 90 days: three traumas within 12 months lead to a one-year suspension.	• Type of Evidence - Medical guidelines, *World Association of Kickboxing Organisations* • Medical supervisors oversee compliance with medical protocols at competitions, submit post-event medical reports to WAKO, and ensure detailed documentation of all injuries, including issuing Head Injury Cards and tracking suspension periods. • Specific management and protocols related to SRC are not detailed within this rulebook.
Kickboxing GB, 2025 [134]	This web source does not define SRC.	This web source does not include specific prevention strategies.	○ Emphasizes identifying signs of SRC and immediately removing individuals from activity ("If in doubt, sit them out").	**RTP** ○ Recommends 24–48 hours of relative rest, including physical and cognitive rest. ○ Gradual reintroduction to ADL's before increasing tolerance for activities and moving to full RTP (six stages).	• Type of Evidence - Web source, *Kickboxing Great Britain* • This web source references the UK Concussion Guidelines for Non-Elite Sport.
World Lacrosse, 2020 [154]	SRC is defined as a brain injury and a complex pathophysiological process induced by biomechanical forces.	This document does not include specific prevention strategies. It mentions online educational resources to promote awareness of SRC.	**Evaluation and Diagnosis** ○ Players suspected of SRC must be removed from play immediately for medical evaluation. ○ Team or event medical officers are responsible for assessing suspected cases. ○ SCAT5 is the recommended tool for evaluation, supported by the Pocket CRT for initial sideline assessments.	**SRC Management** ○ The policy mentions the implementation of a GRTP protocol. It emphasizes that athletes must progress through the GRTP under medical supervision and obtain clearance before RTP but leaves the design of the protocol to the discretion of the medical staff.	• Type of Evidence - Concussion policy, *World Lacrosse* • The policy does not include specific RTP stages or detailed sideline evaluation steps. It focuses on general guidelines, emphasizing medical oversight.
Lacrosse Canada, 2024 [61]	SRC is a form of TBI that occurs from biomechanical forces.	Recommended prevention measures include SRC pre-	**Sideline Information**	**SRC Management**	• Type of Evidence - Concussion guidelines, *Lacrosse Canada*

	Resulting signs and symptoms often resolve spontaneously (1-4 weeks from injury).	season education and proper equipment usage.	○ Athletes with suspected SRC must be removed from play immediately and referred for assessment. Emergency referral is required for severe symptoms. ○ Emphasises recognition of observable signs (e.g. disorientation, confusion) and symptoms (e.g. dizziness, sensitivity). ○ Recommends the use of the SCAT6, Child SCAT6, and CRT by trained professionals for diagnosis. ○ Athletes must provide documentation (e.g., medical assessment letters) before progressing into the SRC management stages.	○ Athletes require 24–48 hours of relative cognitive and physical rest before resuming activities. ○ Each stage requires at least 24 hours, being symptom-free. Players experiencing recurring symptoms must regress to the previous stage. ○ Stage 1**:** ADL. ○ Stage 2**:** Moderate and light effort activities. ○ Stage 3**:** Sport-specific activities without risk of head impacts. ○ Stage 4**:** Non-contact training drills at high intensity. ○ Stage 5**:** Full-contact practice (medical clearance). ○ Stage 6**:** Full RTS (competition).	• Aligns with the Parachute Canadian Guideline on Concussion in Sport. • Discusses referral to an interdisciplinary SRC clinic or a MP to develop an individualized treatment plan, potentially involving specialists (e.g. neurologists, neuropsychologists, and physiotherapists).
NZ Lacrosse, 2024 [139]	The document does not explicitly define SRC.	Prevention measures are not discussed.	**SRC Identification** ○ Any player suspected of SRC must be immediately removed from play or training. The incident must be reported to the Operations Manager. ○ Players suspected of SRC are not allowed to return to play the same day and are strongly encouraged to seek medical attention. ○ This policy does not provide specific sideline evaluation steps or detailed components.	**GRTP** ○ Stages 1–4**:** Gradual progression from relative rest (1–2 days) to light exercise (days 3–9) and non-contact lacrosse drills (days 10–18). ○ Stages 5–7**:** Medical clearance is required before full training (days 18–20) and RTP (day 21). ○ A minimum of 21 days is required before returning to competition, with progression contingent on being symptom-free at each stage. Persistent symptoms require further medical evaluation.	• Type of Evidence - Concussion policy, *New Zealand Lacrosse* • This policy follows ACC National guidelines and World Lacrosse SRC policy.
Echemendia & Hong, 2023 [119]	SRC is defined as a TBI induced by biomechanical forces caused by a direct blow to the head, face, neck, or body, with forces transmitted to the brain. Symptoms result in a functional disturbance and can resolve spontaneously or evolve.	Encourages pre-season baseline testing and EAP's, though prevention measures are not directly outlined.	**Sideline Information** ○ Players showing signs/symptoms must be removed from play immediately and not allowed to return the same day. Medical evaluation is necessary. ○ The guideline recommends tools (e.g. SCAT5, Child SCAT5) for evaluations by HCP. ○ Specific sideline evaluation protocols or detailed steps are not provided, leaving the process largely dependent on medical expertise.	**Graduated RTS Protocol** ○ Gradual progression through six stages (after 24-48 hours of relative rest): ○ Symptom-limited activities, light aerobic exercise, sport-specific drills, non-contact training, Full-contact practice, and return to competition. ○ Each stage requires 24 hours symptom-free before progressing; regress if symptoms recur. ○ Guideline includes process of reintegration into academic activities before RTS. There is no information provided about long-term care or management.	• Type of Evidence - Concussion guidelines, *USA Lacrosse* • Aligns with the *2017 Berlin CISG statement* on SRC.
Canada Rugby League, 2019 [100]	SRC is described as a TBI caused by the brain being shaken inside the skull.	Mandatory review of SRC awareness resources, including Rowan's Law, for stakeholders and medical staff.	**Sideline Information** ○ Players with suspected SRC must be removed from play immediately and not return on the same day. ○ A qualified MP is required to confirm SRC and determine readiness for RTP. ○ The document does not include specific sideline evaluation protocols. The focus is on immediate removal, observation, and reporting procedures.	**GRTP** ○ Athletes must have complete physical and cognitive rest until symptom-free for at least 24 hours without medication. ○ GRTP must be completed symptom-free at each stage (24 hours per stage as a minimum). Individual timelines are determined by MP. If symptoms recur, players must regress to the previous stage. ○ Step 1**:** Light aerobic activity ○ Step 2**:** Sport-specific exercises (e.g., drills without contact).	• Type of Evidence - Concussion policy, *Canada Rugby League* • Highlights the risks of returning to play too soon, particularly in younger athletes, due to the potential for severe brain swelling or permanent damage (SIS, PCS). No long-term management strategies are included.

				○ Step 3**:** Non-contact training drills ○ Step 4**:** Full-contact practice after medical clearance. ○ Step 5**:** Return to competition.	
SARU, 2024 [62]	SRC is a brain injury caused by direct or indirect trauma that transmits force to the brain, leading to impaired brain function. It is a functional disturbance, not a structural injury. SRC presents with a range of signs and symptoms that resolve sequentially, and LOC is not required.	Prevention measures include education (i.e. BokSmart programme), enforcement (i.e. policies, proper game play), enhancement (i.e. tackling techniques), equipment, and proper evaluation.	**Sideline Information** • Guidance suggests the 6 R's: recognise, remove, refer, rest, recover, return. Players showing any signs of SRC must be immediately removed from play. • Blue card process: A referee or MP issues a Blue Card to indicate a suspected SRC. The player is then permanently removed, logged into the system, and automatic medical follow-up and RTS guidance are initiated. • HIA process consists of three stages: HIA1 (on-field assessment using video review and clinical signs), HIA2 (post-game medical evaluation within 3 hours), and HIA3 (final follow-up assessment 36–48 hours later) to confirm or rule out SRC.	**GRTS and Long-Term Management** • 24–48 hours of relative rest before starting activity. Progressive stages must not have symptoms recur, or the player must regress to the previous stage. ○ Daily activities (symptom-limited). ○ Light aerobic exercise (e.g., walking, cycling). ○ Sport-specific drills (no contact). ○ Non-contact training. ○ Full-contact practice (requires medical clearance). ○ Return to competition (minimum 21 days). • Information is provided on long-term effects of SRC (education). Players with persistent symptoms (>21 days) require further medical assessment**.** ○ Independent consultants are recommended for cases with prior SRC history.	• Type of Evidence - Web source, *South Africa Rugby* • The South African rugby SRC guidelines and management practices are centralized on a single web platform**,** with various documents outlining specific protocols. The documents cover HIA protocols (aligned with World Rugby), RTP guidelines, on-field management, and recommended assessments for SRC.
HEADCASE, 2023 [67]	SRC is defined as a TBI caused by an impact to the head, neck, or body, transmitting an impulsive force to the brain. It results in a disturbance of brain function, affecting thinking, memory, and behaviour.	Prevention includes education (e.g. Headcase Programme), and protective measures (e.g. equipment, tackling techniques, exercise training).	**Immediate Action** ○ Players showing any signs or symptoms of SRC must be immediately removed from play ("recognise and remove"). ○ Assessment tools are recommended (e.g. SCAT6, SCOAT6 for HCP, CRT6 for non-medical). ○ Players must seek medical evaluation within 24 hours**.** ○ All HCP and stakeholders should be vigilant in identifying SRC. Red flag symptoms require emergency referral**.**	**RTP Timeline** ○ 24–48 hours of relative rest before progressing to activity. Players must remain symptom-free for 14 days before resuming full-contact activities. If symptoms recur, they must revert to the previous stage**.** ○ Rest is followed by progressive activity stages: light daily activities, aerobic exercise, non-contact rugby drills, and full-contact training. ○ Multiple SRC require individualized management plans and possible specialist referral. The evidence discusses SIS and prolonged effects (medical referral).	• Type of Evidence - Concussion program, *Rugby Football Union* • This document is part of an educational programme from the RFU. It provides comprehensive SRC management guidance for all levels of community rugby in England. • This evidence aligns with World Rugby and the UK Concussion Guidelines for Sport.
Softball Canada, 2025 [52]	SRC is a brain injury that cannot be seen on standard imaging and affects how an athlete thinks and functions. It occurs from a blow to the head, face, neck, or body that causes the brain to move within the skull. Symptoms can appear immediately or develop within 24–48 hours**.**	A pre-season education sheet is provided for information on recognition, symptoms, and proper management**.**	**Onsite Medical Assessment** ○ Any athlete suspected of having SRC must be immediately removed from play and cannot return the same day**.** Coaches and stakeholders are responsible for ensuring that players are evaluated. ○ Those with suspected SRC are required to seek HCP and MP evaluation. Written medical clearance is required before RTP.	**SRC Management Strategies** ○ A 24–48-hour rest period is recommended before gradually resuming activities and RTP. Players must remain symptom-free for at least 24 hours at each stage before progressing. ○ Stage 1**:** Symptom-limited daily activities. ○ Stage 2**:** Light aerobic activity (e.g., walking). ○ Stage 3**:** Sport-specific drills (e.g., running, throwing, catching). ○ Stage 4**:** Non-contact training. ○ Stage 5**:** Full-contact practice after medical clearance**.** ○ Stage 6**:** Return to normal game play. ○ A return-to-school strategy is also provided when applicable. Athletes must obtain a medical clearance letter from an HCP before returning to activities.	• Type of Evidence - Concussion protocol, *Softball Canada* • Aligns with Parachute Canada recommendations for SRC.

				○ Multidisciplinary SRC clinics are recommended for athletes with persistent symptoms, providing coordinated care from specialists such as physicians, physiotherapists, and neuropsychologists (long-term symptoms).	
World Taekwondo, 2019 **(159)**	The document does not explicitly define SRC.	Competition safety measures are required. This includes ringside medical stations at all competitions with qualified medical staff and mandatory pre-competition medical evaluations.	**Event Medical Assessments** ○ Any KO (LOC, AMS, inability to perform voluntary movements due to direct head trauma) lasting at least 10 seconds is classified as a SRC. ○ Athletes with suspected SRC or head trauma face mandatory suspension periods (30–180 days depending on severity). ○ All injured athletes must undergo a secondary medical assessment in the venue medical room before leaving the venue.	**SRC Management Strategies** ○ Athletes diagnosed with a SRC must be removed from competition and monitored for symptoms. ○ There are mandatory suspension periods (by age) which are recorded to ensure compliance with RTS protocols: ○ 30 days (senior athletes). ○ 40 days (junior athletes). ○ 50 days (cadet athletes). ○ 90–180 days for multiple SRC within a 90–180-day period. ○ Athletes must follow a structured rehabilitation programme and obtain medical clearance from a neurologist or HCP before RTS.	• Type of Evidence - Medical code: concussion guidance, *World Taekwondo* • This guideline provides general medical protocols for World Taekwondo competitions, which include SRC management alongside broader medical regulations.
Taekwondo Canada, 2021 **(70)**	Taekwondo Canada follows the Parachute Canada definition of concussion.	There is mandatory SRC education, in addition to pre-season education sheets provided. Further safety measures include limited contact drills, proper equipment, and policy changes.	**Immediate Sideline Assessment** ○ Athletes suspected of having a concussion must be immediately removed from play. Sideline medical assessment should be conducted if there is HCP present. ○ Athletes must undergo a full medical assessment by a MP before RTP. If SRC is diagnosed, a medical assessment letter must be issued. MP must be on-site of SRC event. ○ Head injury recognition is emphasised. Emergency referral is required for severe symptoms (e.g. CRT5 for non-medical).	**Taekwondo-Specific RTP Process** ○ A 24–48-hour rest period is recommended before starting recovery. This protocol emphasises a gradual reintegration to school before progressing to RTS. ○ If symptoms recur, the athlete must revert to the previous stage. ○ It follows a stepwise progression starting with symptom-limited ADL's and light aerobic exercise, then advancing to low-intensity sport-specific drills and non-contact training. Full-contact practice is only permitted after medical clearance. ○ Long-term care: Referral to multidisciplinary clinics is suggested on an individual basis if needed for long-term care.	• Type of Evidence - Concussion protocol, *Taekwondo Canada* • Aligns with Parachute Canada recommendations for SRC. • Taekwondo Canada requires medical clearance**,** which supersedes World Taekwondo rules for Canadian-sanctioned events.
FIVB, 2024 **(140)**	The document does not define SRC.	This protocol does not include specific prevention strategies.	**SRC Assessment** ○ Players suspected of having a SRC must not RTP and should be evaluated by a trained HCP. ○ The protocol does not provide specific details on sideline assessments beyond recommending medical evaluation and SCAT5 use.	**Graduated RTS Protocol** ○ Initial rest period of 24–48 hours (relative physical and cognitive rest) before beginning activity. ○ RTS process gradually reintegrates athletes into volleyball after SRC, beginning with rest followed by light activities, sport-specific drills, non-contact training, and full-contact practice (after medical clearance)**.** ○ The document provides minimal detail on rehabilitation. ○ Symptom-free progression through 24-hour stages is required, with regression if symptoms recur.	• Type of Evidence - Concussion protocol, *The International Volleyball Federation* • Aligns with the *2017 Berlin CISG statement* guidelines.

Volleyball Canada, 2024 **(89)**	The document does not define SRC.	Players and parents must review and sign the pre-season education sheet.	**SRC Evaluations and Recognition** ○ Any player suspected of SRC must be immediately removed from play and cannot return the same day**.** ○ Emergency referral is required for severe injury, including head, neck, and spine injuries. ○ Sideline evaluation (by MP) using SCAT6 is required, unless MP is unavailable. Athlete must be referred for medical evaluation and clearance (i.e. medical clearance letter). ○ The document does not provide a detailed step-by-step sideline evaluation protocol.	**Volleyball-Specific RTP Process** ○ To begin, athlete must have 24-48 hours of relative rest before starting the recovery process. After this, each stage requires at least 24 hours, and symptom recurrence requires regression to the previous stage. ○ Emphasis on a gradual reintroduction into academic activities before sport progression. ○ RTS follows a six-stage progression, starting with symptom-limited daily activities, light aerobic exercise**,** volleyball-specific drills and advancing to non-contact training**.** Full-contact practice is only allowed after medical clearance, with a final return to competition.	• Type of Evidence - Concussion protocol, *Volleyball Canada* • Aligns with Parachute Canada recommendations for SRC. • Interdisciplinary care is recommended for those who experience prolonged symptoms (aiding to individualised needs).
Wrestling Canada Lutte, 2018 **(103)**	The document does not define SRC.	Players and parents must review and sign the pre-season education sheet.	**SRC Evaluations and Recognition** ○ Any player suspected of SRC must be immediately removed from play and cannot return the same day**.** ○ Emergency referral is required for severe injury, including head, neck, and spine injuries. ○ Sideline evaluation (by MP) using SCAT5 is required, unless MP is unavailable. Athlete must be referred for medical evaluation and clearance (i.e. medical clearance letter). ○ The document does not provide a detailed step-by-step sideline evaluation protocol.	**Wrestling-Specific RTP Process** ○ Athlete must have 24-48 hours of relative rest before starting the recovery process. After this, each stage requires at least 24 hours, and symptom recurrence requires regression to the previous stage. ○ Emphasis on a gradual reintroduction into academic activities before sport progression. ○ RTS follows a six-stage progression, starting with symptom-limited daily activities, light aerobic exercise**,** sport-specific drills and advancing to non-contact wrestling training**.** Full-contact practice is only allowed after medical clearance, with a final return to competition (i.e. medical clearance letter).	• Type of Evidence - Concussion protocol, *Wrestling Canada Lutte* • Multidisciplinary care teams are recommended for those who experience prolonged symptoms.
Falahati, 2021 **(123)**	SRC is a TBI that results in a disturbance of brain function. LOC is not required for diagnosis.	This guidance does not include specific prevention strategies.	**Sideline Information** ○ Any athlete suspected of SRC must be immediately removed from play. Return on the same day is not allowed. ○ Emergency referral is required for severe injury. Athletes should be seen by a HCP to confirm diagnosis and receive guidance on recovery. ○ This guideline does not provide specific sideline protocols. It focuses on recognising SRC symptoms and signs, with an emphasis on immediate removal and emergency referral for severe cases.	**SRC Management** ○ 24–48 hours of relative rest (cognitive and physical). ○ Guideline includes a stepwise approach to returning to normal life before progressing to a GRTS. ○ Return to normal life focuses on gradually reintegrating ADL's to ensure cognitive and physical readiness before resuming sport. ○ GRTS is a structured progression through increasing physical exertion levels, starting with light aerobic exercise and advancing to full-contact training and competition, with mandatory medical clearance before RTP. ○ GRTS requires a minimum of 12 days (adults) and 23 days (under 19s) before return to competition.	• Type of Evidence - Concussion guidance, *British Wrestling* • Aligns with the *2017 Berlin CISG statement.* • Athletes with multiple SRC are referred to experienced HCP.
USA Wrestling, 2023 **(143)**	The document does not define SRC.	This guidance does not include specific prevention strategies.	**Immediate Action** ○ If a wrestler has LOC or suspected of SRC**,** the match is stopped, and tournament medical staff has unlimited time to evaluate the athlete.	**RTP Requirements** ○ Multi-step RTP process is recommended**,** though specific stages are not outlined in the document. ○ Minimum 24-hour removal from competition. ○ Written medical clearance is required (HCP/MP).	• Type of Evidence - Concussion guidance, *USA Wrestling*

			○ If SRC is suspected, the athlete is placed on ‘medical hold’ (yellow alert) for evaluation to happen by HCP/MP. ○ If SRC is confirmed, ‘red alert’ is issued, with removal of athlete from competition. ○ The document does not provide a specific sideline evaluation protocol, but it mandates immediate medical assessment and documentation.		

Appendix X: Participant Materials

9.15 Qualitative Study Materials

9.15.1 Participant Information Sheet

INVITATION TO PARTICIPATE IN A RESEARCH STUDY

Medical Professionals' Approaches to Sport-Related Concussion Management amongst High-Performance Athletes: A Qualitative Study

We would like to invite you to participate in this research and thank you for your interest to take part. Before you decide whether to participate, we would like you to understand why the research is being done and what it would involve for you. Please ensure to read the following information carefully before providing consent to participate. All members of the research team are available to answer questions you may have prior to your involvement, and our contact information is available on this document.

What is the purpose of the study?

Sport-relate concussions (SRC) are a globally relevant issue, with high confusion surrounding up-to-date operational definitions and best-option treatment plans. However, SRC recommendations towards treatment and management are highly heterogenous. The purpose of this research is to examine the current approaches and attitudes of medical professionals working within high performance athletics as it relates to the diagnosis, treatment, and management of SRC.

We are inviting health care and sports-medicine professionals working within the field of SRC to take part in this study by attending a focus group to discuss experiences with various SRC protocols and guidelines. We hope that the results of this study will allow for there to be a further understanding of areas of improvement within SRC strategies and implementation, as well as allow for a synthesis of which protocols are experientially useful. This research is being done in relation to a Master's by Research Degree (MSD) for student researcher Leeza Voyevoda through the University of Essex under the supervision of Dr. Benjamin Jones and Dr. Andrew Brinkley, with co-investigator Dr. Kate Pittaccio.

Why have I been invited to participate? Who can take part?

You will be able to take part if:

- You are working/or have worked within SRC diagnosis, management, and treatment. This may include professions such as physiotherapists, general practitioners, sports/athletic therapists, nurses, neurologists, and more.
- You are certified by the Health and Care Professions Council (HCPC) or an equivalent regulatory body.
- You are willing to be interviewed and audio recorded.
- You can read and understand English.

Do I have to take part?

This research is entirely voluntary. It is up to you whether you decide to participate in this research study. You can withdraw at any point, for any reason, and without explanation or penalty.

What will happen if I take part?

If you decide you are willing to be involved within this research, the research team will check you are eligible to participate. Once eligibility is confirmed and any of your questions have been answered, we can then arrange dates and times for a focus group where and when most convenient for you. Prior to when the focus group begins, you will be given a form to provide your consent to participate. In addition to this, demographic data will be requested from participants. This includes age, gender, profession, years of experience, and sport specialization. All policies of anonymity and confidentiality apply to this collected information.

The group interviews will be held with the lead researcher, Leeza Voyevoda. Other researchers within the team may also be present during the focus group. It will take approximately 60-100 minutes to complete, depending on the length and depth of conversation. If you are unable to attend the focus group, there is an option for in-person or video platform assisted one-on-one interviews. Data collection will take place on one occasion, unless you decide you would like to speak with the researchers again. All interviews will be audio recorded and transcribed into written word.

Will my information be kept confidential? Can I change my mind?

You will have a right to confidentiality and to anonymity. Your participation will remain confidential, and no personal information will be shared when data collection is completed. However, during data collection, if you or anyone within the discussion discloses information indicating risk of harm to themselves or others, there is a duty of care to inform appropriate authority.

Any identifiable information, or information you do not want discussed, will remain strictly confidential and unable to be seen by anyone else asides the members of the research team. The members of the research team who will have access are Leeza Voyevoda, Dr. Benjamin Jones, Dr. Andrew Brinkley, and Dr. Kate Pittaccio. Your name and any professional identifiers will be removed, and you will remain unidentifiable through pseudonymization.

Your participation in this study is entirely voluntary, so you are free to withdraw or stop participation at any time with no consequences. This means that you can stop the interview at any time or decide to withdraw once the interview is completed. This also means you can pause the interview if a break is needed. Your reasons for withdrawing will not be necessary. However, once the findings of the study are reported, it may not be possible to remove your participation from the data.

All audio recordings or notes gathered will be immediately encrypted and deleted once transcribed and properly anonymized. All data will be electronically stored on the secure University of Essex Box Drive, which is the University IT system. This data will be retained for a period of ten years from once the project is completed.

Are there any risks, disadvantages and/or benefits of my involvement?

There may be minor risks by deciding to participate in this study. You have the right to refuse discussing or responding to any interview question that may be asked. However, there may be questions that ask about circumstances that are associated to some discomfort or distress.

There may be some inconvenience involved when participating, as we are asking for some of your time in exchange for research information. There are no direct benefits to you

by participating within this research. However, your participation will allow for themes to be explored within practitioners and health care professionals' experiences of SRC.

What information will be collected?

Demographic information will be collected. This includes age, gender, profession, years of experience, and sport specialization. All this information will comply with policies of confidentiality and will not be identifiable to you.

Consent information will be collected. On a separate document, this consent form will identify statements of your understanding related to the project, and will require your initials, signature, and name.

When in focus groups or interviews, themes of sport-related concussion and clinical experience will be discussed. You can refuse answering questions, however if you choose to answer, information will be recorded and transcribed. All the information that you provide will be anonymized, and personal identifiers will be removed. However, this information will be used in later analysis to discover any patterns between healthcare professionals.

What happens with the results of the study?

The research team will use the collected data to complete a thematic analysis to discover patterns throughout the interviews. As this is part of a master's dissertation, findings will be put together within a final research project report to be evaluated. Findings may also be presented at conferences and prepared into scientific papers. Final findings and presentations of the research will comply with policies of confidentiality and anonymity. Data will be confidentially entered into the Open Science Framework (OSF), allowing for open data to be accessible to other researchers. The OSF is a project management tool that allows research findings to be accessed openly by other researchers to boost efficiency within the field.

This research is being done in relation to a Master's by Research Degree (MSD) for student researcher Leeza Voyevoda through the University of Essex. Findings of the research will be used in a dissertation. If at the end of your participation, you would like a copy of the findings of the study, please contact any members of the research team and that will be made available to you.

What is the legal basis for using the data and who is the Data Controller?

The UK General Data Protection Regulation (UK GDPR) sets out data protection and legal basis for data processing. Separate to this document, there is a consent form that establishes your decision on participation. This is a clear, specific statement regarding voluntary participation within this study. This consent form clearly summarizes your right to withdraw at any time, for any reason without explanation or penalty. This consent form is the legal basis for processing your data.

The data controller for this project is the University of Essex. The University Information Assurance Manager is the contact for this (email: dpo@essex.ac.uk).

Who is funding the research?

There are no sponsors or organisations that are funding this research. This project is being is done in relation to a master's degree for researcher Leeza Voyevoda. This degree is being externally funded.

Who has reviewed the study?

The Ethics Sub Committee 2 at The University of Essex has granted ethical approval of this project. The ethics reference number is ETH2324-2077.

What should I do if I want to take part?

Once you fully read this Participant Information Sheet, you can contact any members of the research team. Contact details are available at the bottom of this sheet. If you feel as though you have had sufficient time to decide on your participation, a consent form will be sent or given to you to complete.

Concerns and Complaints

If you have any concerns about any aspect of the study or have any complaints, please contact the student principal investigator of the project, Leeza Voyevoda, immediately using the contact information below. If you remain concerned or feel as though you need to contact someone else to address your concern, please contact the departmental Director of Research. The Director of Research for the School of Sport, Rehabilitation and Exercise Sciences is Dr. Ruth Lowry (email: r.lowry@essex.ac.uk). If you are still not satisfied, please contact the University of Essex Research Integrity Manager, Mantalena Sotiriadou (email: ms21994@essex.ac.uk).

Name of the Researcher/Research Team Members

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We would like to thank you for your interest in this study!

9.15.2 Consent Form

INFORMED CONSENT FORM

Medical Professionals' Approaches to Sport-Related Concussion Management amongst High-Performance Athletes: A Qualitative Study

Research Team: Leeza Voyevoda, Dr. Andrew Brinkley, Dr. Benjamin Jones, Dr. Kate Pittaccio

Participant Name:

Date: Please initial box:

1. I confirm that I have read and understand the Participant Information sheet for the above study. I have had an opportunity to review the information and ask questions. All questions have been answered satisfactorily.	
2. I understand that my participation is voluntary and that I may withdraw from the project at any time without giving any reason and without penalty.	
3. I understand that unless stated otherwise, I agree for the collected data to be used for the study.	
4. I agree to being interviewed with audio recording, and notes being taken during the interview if needed.	
5. I understand that, due to the nature of the discussions, there is a risk of emotional disturbance and discussion of topics that may bring up topics, memories, or thoughts of a distressing nature.	
6. I understand that the data (audio recordings) provided will be securely stored and accessible only to the members of the research team directly involved in the project, and that confidentiality will be maintained. I give permission for these individuals to have access to my data.	
7. I understand that my fully anonymized data will be used for published research papers, presentations, and reports.	
8. I understand that the data collected about me will be used to support other research in the future and may be shared anonymously with other researchers. All anonymized data will be uploaded and remain on the Open Science Framework.	
9. I give permission for the anonymized transcribed recordings generated from this study to be deposited in the open science framework so that they will be available for future research and learning.	
10. I agree to take part in the above study.	

Please print and sign your name.

Participant Name: Date: Participant Signature:

Researcher Name: Date: Researcher Signature:

9.15.3 Demographic Form

Medical Professionals' Approaches to Sport-Related **Concussion Management amongst High-Performance Athletes: A Qualitative Study**

General demographic data is requested from participants. All information will align with policies of confidentiality. Access to all demographic data will be restricted to the members of the research team. In the case that you prefer digital responses, please answer the demographic questions within the Qualtrics link below:

https://essex.eu.qualtrics.com/jfe/form/SV_dhitJ8hkB8pKR0O

GETTING TO KNOW YOU

Your Name (First and Last)

Your Age **Gender**

_____ _____

Qualifications (List all that apply)

Which certifications do you possess? Which regulatory body granted your licensing/qualification? Etc.

_____

_____

Years of Experience

_____

Main Sport? (List all that apply)

_____

_____

Appendix XI: Interview Guide

Medical Professionals' Approaches to Sport-Related Concussion Management amongst High-Performance Athletes: A Qualitative Study

1. **Warm-Up Questions:**
   - "Can you briefly introduce yourself and describe your experience with sport-related concussions?"
   - "Which sports do you primarily work with, and how often do you encounter SRCs?"
   - "In one word, how would you describe the current state of concussion management in sports?"

2. **Discussion Questions**

   Understanding and Awareness of SRC
   - "What is your understanding of sport-related concussions (SRC) – i.e. if someone were to ask for a definition, how would you yourself choose to define it?"
     - *Follow-up*: "How have your views on SRC evolved over time?"
   - "Of the existing SRC guidelines, which ones are you aware of, and which do you most commonly apply in your practice?"
     - *Follow-up*: "Can you provide an example of a situation where a specific guideline influenced your approach to managing an SRC?"
   - "How do you typically receive new information about SRCs?"
     - *Follow-up*: "Can you share an example of a time when new information influenced your practice?"
   - "How do you feel about the current methods used for diagnosing, treating, and managing SRCs?"
     - *Follow-up*: "Have your experiences in dealing with SRCs changed as you have learned more about them?"
   - "What emotions do you experience when dealing with a case of SRC?"
     - *Follow-up*: "Have you noticed differences in how SRCs are managed by different healthcare professionals?"
   - "How do you perceive the role of education and knowledge dissemination in improving the management of SRC?"
     - "Can you share any experiences where education played a role in improving or worsening outcomes?"

   Barriers, Facilitators, and Reflections in SRC Management
   - "What are some of the most challenging barriers you face when diagnosing and managing SRCs?"
     - *Follow-up*: "How do the current suggested approaches create challenges in your treatment plans?"
   - "What is your preferred method for accessing new information about SRCs?"

    - *Follow-up*: "How could this information be made more accessible to you, especially in the professional or field setting?"
- "Can you discuss a memorable time that you have interacted with SRC? (Whether it be in diagnosis, management, injury occurrence, or treatment phases)"
    - *Follow-up:* "How does this personal experience impact your choices when interacting with SRC now?"
- "Can you describe any experiences where you have faced dilemmas in managing SRC?
    - "How do you personally navigate these dilemmas?"

Future Strategies and Improvements

- "In your opinion, what is the best current approach to managing SRCs? How could this approach be improved?"
    - *Follow-up*: "What specific changes would you like to see in the current guidelines or protocols?"
        - What do you personally feel is a weak approach and why? (i.e. what portions would you keep, change, adapt?)
        - Do you notice changes or differences in SRC culture across different sports?
- "Is there any information regarding SRCs that you believe is outdated?"
    - *Follow-up*: "What would you suggest should be updated or remain in the existing guidelines?"
- "Can you suggest any new approaches or strategies that could improve the management of SRCs?"
    - *Follow-up*: "How do you think these strategies could benefit other healthcare professionals?"
        - *"*What changes do you think need to happen for progress to be made within concussion management?"
- "What aspects of the current environment surrounding SRC do you enjoy?"
    - *Follow-up:* what portions would you keep the same? (i.e. opportunity for positive dialogue)
- **"**If you were to personally design or create an ideal SRC program, from diagnosis to treatment to management, what key components would be included?"
    - "How would this program address the challenges you have personally encountered within your career?

Appendix XII: Reflexive Research Journal Excerpts

August 19, 2024

Today I reflected on the inevitability of bias in this kind of research. I assumed that I could remain objective, detached, and uninfluential in my role as researcher. That assumption overlooks the nature of qualitative inquiry. There is a dual-direction influence at play. Not only am I shaping the research, but the process is also shaping me. This project is inherently transactional. I'm spending time and resources alongside participants who are generously sharing their expertise and real-world experiences, which ultimately benefit the development of my project. That dynamic is not neutral.

A very important characteristic or trait for a researcher to have is to be aware of insights, to examine their assumptions, rapport, choices, and questions. I need to be aware of the impacts of positionality- not only am I a researcher delving into exploratory work, I am also a first-time researcher, first-time master's student, and taking first steps in my realm of my career. I am very aware of my inexperience and uncertainty. These feelings sometimes manifest as fear. Fear of getting it wrong, fear of not understanding the data, or fear of failure.

August 29, 2024

As I worked on finalising the interview guide, I became overwhelmed by doubt. I am worried that I won't be prepared or ask the "right" questions. There's a persistent fear that one poorly framed prompt or poorly timed follow-up could negatively affect the entire study. However, I'm starting to understand that qualitative interviewing isn't about perfect structure. It's about flexibility. Each participant I speak to will bring a different energy, set of experiences, and expectations. There is no one-size-fits-all method. I'm learning that I need to remain adaptable. The interview guide is there as a resource, not a script. Creating space for unexpected insights, while still covering core topics, is part of what makes this process both challenging and rewarding.

December 3, 2024

Conducted my second interview today. It felt quite different from the first. It was less structured and more conversational. I found myself relaxing into the flow and allowing the participant to take more ownership of the discussion. That said, I caught myself nodding frequently when I agreed with certain points. I began to wonder whether I was inadvertently encouraging or reinforcing particular responses. That's something I need to stay conscious of. I also found it much easier to ask open-ended questions when the participant was more forthcoming. It reminded me that while the guide exists to support the conversation, it shouldn't restrict it. My role is to follow the dialogue where it naturally wants to go, without forcing responses into predefined categories.

January 4, 2025

A participant raised concerns about how “someone needs to take responsibility” for SRC care. It caught me off guard! I realised I had assumed all practitioners already felt personally accountable. That comment stuck with me and made me think about how responsibility is shared in different clinical settings. I want to make sure I pay attention to potential themes like this in the future.

Following interviews, I also noticed that I felt a lot of sympathy when participants described their frustrations with SRC. I was proud that I was able to remain neutral during conversations and not project my own experiences or over-identify with what was being shared. Still, I think my background in sports, and someone who’s witnessed concussions firsthand, subtly shapes how I process what they’re saying. My own beliefs about SRC being complex and "different" from other injuries will impact how I interpret certain anecdotes or opinions. Overall, these interviews are teaching me just as much about myself as they are about the topic. I'm learning to recognise my assumptions as they arise and to actively bracket them when reviewing transcripts. Memo-writing after each session has helped me catch moments where I may have leaned too hard into a theme that resonated with me personally. I have found immediate transcription helpful, as I can jot down notes as I transcribe. That way, I am fully engaged when interviewing. All of this reflexivity work has allowed me to acknowledge, manage, and be honest about bias and how how it informs the research journey.

Section 10 - Reference List

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