



**Exploring sport-related concussion recovery outcomes: A review and synthesis
of the literature**

Prepared by the Sport Information Resource Centre (SIRC)

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Introduction

Sport-related concussions (SRC), or mild traumatic brain injuries, are caused by a hit to the head or body (McCrory et al., 2017). SRC can lead to a wide range of short and long-term symptoms, affecting how an athlete thinks, feels and acts. While research indicates that athletes will typically recover from an SRC within 1 month of their injury, there are instances where recovery may take longer (Ellis et al., 2018; McCrory et al., 2017). Longer recovery times can negatively affect an athlete's overall health and well-being (Ellis et al., 2018). For example, research indicates that athletes who take longer to recover from an SRC are at risk of experiencing anxiety and depression, which can impact their quality of life and their ability to engage in their everyday activities, such as sports (Ellis et al., 2018).

Researchers have identified several factors that can positively and negatively impact an athlete's SRC recovery trajectory (Eagle et al., 2020). Some factors, such as an athlete's age or biological sex, are non-modifiable (meaning they cannot be changed). Whereas others, such as the care an athlete receives after their injury, are modifiable (meaning they can be changed). Understanding how both modifiable and non-modifiable factors influence recovery is crucial as it may help sport participants and sport leaders:

- ▶ Understand how individual characteristics and differences impact concussion recovery times
- ▶ Identify strategies that can be used to support athletes in their recovery process, including the creation of more personalized recovery plans
- ▶ Change perceptions, attitudes and discussions around SRC recovery to promote more positive recovery experiences for athletes who have sustained an SRC

Note: It is important to remember that research on some factors discussed within this review is limited. One such limitation is that many of the studies have been performed on homogeneous samples, and thus the findings may not relate to the broader public (Aggarwal et al., 2020). Additionally, studies used varying definitions for recovery. While recovery is generally defined as the time it takes an athlete to return to normal activities such as school and sports (McCrory et al., 2016; Merritt et al., 2019), some studies defined recovery as the time it took to reach symptom resolution. We have done our best to indicate how the researchers defined recovery to improve the clarity of the findings. With those limitations in mind, the information in this review should not be used to replace medical advice. Rather, it should be used to continue our discussions around SRC and to inform future research and practice.

Purpose and objectives

This review summarizes the research exploring key modifiable and non-modifiable factors that may influence an athlete's SRC recovery. By summarizing this research, we aim to:

- ▶ Provide an overview of evidence-based factors that may impact an athlete's SRC recovery time
- ▶ Help sport leaders, team trainers and athletes understand the importance of taking an individualized approach to SRC management
- ▶ Highlight current best practices for supporting athletes during their recovery process
- ▶ Identify future directions for research and practice

To achieve these objectives, the literature review has been separated into 3 sections. These sections are outlined below.

Section 1: Non-modifiable factors	Section 2: Modifiable factors	Section 3: Summary and next steps
<ul style="list-style-type: none">• Biological sex• Age• Race• Pre-existing medical conditions	<ul style="list-style-type: none">• Rest and exercise• Seeking timely medical care• Social support	<ul style="list-style-type: none">• Resources for continued learning

Search strategy

To explore the literature focused on SRC recovery, 3 databases (PubMed, Web of Science and Google Scholar) were searched between September 2022 and January 2023. Initial search terms were "concussion" AND "sport" AND "recovery" OR "outcomes" OR "return to sport" OR "health" OR "predictors". As new topics emerged from papers retrieved during the initial searches, additional search terms such as "mental health", "biological sex" and "exercise" were used. All searches were limited to articles that were published in English. Additional articles were identified through a manual search of the reference lists of articles that were included in the review.

Following full-text review of relevant articles, a total of 56 data sources aligned with the objectives of this literature review and were included in the final report.

Summary of findings

1. Non-modifiable factors

1.1 Biological sex

A growing body of research suggests that biological sex can help predict an athlete's SRC recovery pattern and prognosis. Many studies have demonstrated that female athletes experience a greater number and severity of symptoms following an SRC when compared to male athletes (Covassin et al., 2018; Bretzin et al., 2022; Mollayeva et al., 2018; Neidecker et al., 2017; Resch et al., 2017). Additionally, researchers have noted that symptom presentation between male and female participants often varies, with female participants being more likely to report symptoms such as headaches, sensitivity to light and drowsiness when compared to male participants (Bunt et al., 2020; Covassin et al., 2018; Koerte et al., 2020).

In general, research across different age groups and sports has indicated that female athletes take longer to recover from their concussions than male athletes (Bretzin et al., 2022; Merritt et al., 2019; Mollayeva et al., 2018; Neidecker et al., 2017). For example, a recent study performed in a group of varsity athletes found that female athletes took, on average, 1 day longer for their SRC symptoms to resolve compared to their male counterparts (Bretzin et al., 2022). While differences in recovery time may be associated with the increased number and severity of symptoms experienced by female athletes (Ono et al., 2016), there is evidence to suggest that female athletes take longer than male athletes to recover even when a similar number and severity of symptoms are experienced between the groups (Gallagher et al., 2018).

When it comes to returning to play, this may mean that female athletes require additional time before they can safely re-engage in competitions. For example, in 1 study, researchers found that female soccer players typically took 2 days longer (12 days versus 10 days) to return to play compared to male soccer players (Bretzin et al., 2021). Interestingly, sex-based differences in return to play times may vary depending on sport type (Bretzin et al., 2022; Covassin et al., 2016). As such, it may be beneficial for sport leaders and practitioners to consider sport type when creating a recovery plan. Bretzin and colleagues (2022) recommend that individuals consider how factors such as rules (for example, around body contact), equipment use and differences in style of play between male and female sports may influence an athlete's SRC recovery and their safety in terms of returning to play post-injury.

1.2 Age

In general, researchers suggest that children and adolescent athletes experience longer recovery times following concussion compared to adults (Iverson et al., 2017; McCrory et al., 2017; Scorza & Cole, 2019; Zemek et al., 2016). Additionally, researchers have noted that youth athletes, particularly those in their high school years, are at the highest risk of experiencing persistent post-concussion symptoms (PPCS; Zemek et al., 2016). PPCS is defined as symptoms that last longer than the anticipated recovery times for a specific group (McCrory et al., 2016; Zemek et al., 2016). For adults, PPCS is symptoms lasting for more than 10 to 14 days. In youth, PPCS is symptoms lasting for more than 4 weeks (Zemek et al., 2016). In fact, it has been reported that nearly 25% of youth from the ages of 8 to 12 years and 40% of youth from the ages of 13 to 17 years experience PPCS (Zemek et al., 2016). Interestingly, SRC recovery times may vary within these age groups. For example, Tamura and colleagues (2020) found that athletes from the ages of 14 to 16 years took, on average, 3 to 4 days longer to fully return to sport compared to those over the age of 17 years. Combined, these results suggest that athletes at different ages may take varying amounts of time to recover from their SRC, with youth athletes requiring more time than adults.

Notably, there are some limitations to current research exploring the relationship between age and SRC recovery outcomes (Moser et al., 2018). For example, few studies have included athletes below the age of 13 years in their samples (McCrory et al., 2017). Additionally, how studies have grouped athletes by age appears to vary between studies, making it hard to compare results (Moser et al., 2018). Therefore, more research is needed to study SRC recovery outcomes and trajectories in younger athletes and compare recovery times between more standardized age groups (Moser et al., 2018). In addition to increasing research efforts, there is a need for sport leaders, researchers, and medical practitioners to work collaboratively to tailor SRC protocols and recovery plans to the needs of athletes across all ages (Moser et al., 2018).

1.3 Race

Race is an emerging topic in SRC research. To date, a limited number of studies have considered how racial differences may impact SRC recovery outcomes. However, initial research suggests that an athlete's race may influence the symptoms they experience and their recovery timeline (Aggarwal et al., 2020; Holmes et al., 2016; Yengo-Kahn et al., 2021). For example, a recent study found that Black athletes are more likely to report cognitive symptoms following a concussion when compared to White athletes (Holmes et al., 2016). Additionally, after an SRC, Black athletes' symptoms appear to resolve earlier than White athletes (Yengo-Kahn et al., 2021). Regarding return to play, researchers

suggest that Black athletes return to sport sooner than their White peers (Aggarwal et al., 2020).

That said, researchers have noted that Black athletes may have poorer knowledge about SRC, less access to healthcare resources like doctors and may be less likely to report their SRC (Wallace et al., 2021). All of these factors may negatively affect Black athletes' recovery outcomes (Wallace et al., 2021). With this in mind, education must be improved for all athletes to ensure that all athletes understand the importance of concussion reporting and seeking medical care following a SRC (Wallace et al., 2021).

A notable limitation of the above research was that it was focused on a comparison between a very limited number of races. Research including participants from more races is needed. Additionally, research should be conducted to understand how other social determinants of health (for example, ethnicity and socioeconomic status) can impact athletes' recovery trajectories and how these findings could be used in practice by sport leaders and medical professionals.

1.4 Pre-existing conditions

1.1.1 Mental health challenges

Several studies have explored the relationship between a history of mental health challenges, such as depression or anxiety, and SRC recovery outcomes (Gornall et al., 2020; Iverson et al., 2017; Iverson et al., 2020; Sandel et al., 2017; Zemek et al., 2016). Taken together, these studies indicate that athletes with a history of mental health challenges, in particular a history of depression, may be more likely to experience a longer SRC recovery time compared to those with no history of mental health challenges (Gornall et al., 2020; Iverson et al., 2017; Iverson et al., 2020; Zemek et al., 2016). For example, in a study performed in a large sample of Canadian children, researchers found that over 50% of children who experienced pre-injury depression and nearly 40% of children who experienced pre-injury anxiety reported PPCS (Zemek et al., 2016). Reasons for which individuals with mental health challenges may experience prolonged recoveries may include genetic and environmental factors as well as lower resilience and coping skills (Iverson et al., 2020). However, more research is needed to determine all the mechanisms that contribute to prolonged SRC recovery in athletes with current or past mental health challenges.

In addition to a history of mental health challenges, research indicates that the development of mental health challenges after an SRC may contribute to a prolonged

recovery (Rice et al., 2018). This is a concern as many athletes experience mental health challenges following a concussion (Ledoux et al., 2022). In fact, a study in Canadian youth athletes found that athletes who had sustained a concussion had a 40% increased risk of experiencing mental health problems, like anxiety, when compared to athletes who had sustained an orthopedic injury such as a torn ACL or a sprain (Ledoux et al., 2022). Notably, individuals with pre-existing mental health challenges are more likely to report mental health challenges, such as anxiety or depression, following a SRC (Gornall et al., 2020; Iverson et al., 2017; Sandel et al., 2017; Rice et al., 2018). Overall, mental health challenges may place athletes at a risk of a prolonged recovery.

Researchers suggest including mental health screening for athletes to determine which athletes may need mental health support (Gornall et al., 2020). Helping athletes seek mental health care may help reduce the burden of SRC and improve recovery outcomes (Gornall et al., 2020). Additionally, all sport stakeholders, including parents, coaches and teammates may support athletes' mental health by creating more positive and supportive environments for athletes during their recovery (Gornall et al., 2020). Some strategies for supporting athletes through their recovery are highlighted in the section on social support, which is found in the second section of this review.

1.1.2 Concussion history

While the literature around the role that a history of concussion plays on recovery prognosis is mixed, evidence suggests that having had a concussion in the past may negatively impact an athlete's recovery trajectory (Cook et al., 2022; Ellis et al., 2019; Iverson et al., 2017; Miller et al., 2017). For example, a group of Canadian researchers found that youth who had experienced at least one prior SRC experienced a greater number of SRC symptoms than those who had never experienced an SRC (Ellis et al., 2019). Additionally, the group with a history of SRC took, on average, 2 days longer (25 days compared to 23 days) to recover from their concussion compared to recovering from a concussion the first time (Ellis et al., 2019). As such, athletes with a history of SRC may require more time to recover than their peers with no SRC history. However, more research should be performed to confirm this relationship.

Regardless, athletes with a history of concussions are at a greater risk for future SRC (Reneker et al., 2019). Additionally, in the first few months following an SRC athletes may be at an increased risk of musculoskeletal injury (like sprains; Brooks et al., 2016). Combined, this reinforces the importance of encouraging and allowing athletes to take as much time as they need to recover safely following an SRC.

1.1.3 Migraine disorders

Evidence suggests that a history of migraine disorders may be associated with worse SRC recovery outcomes (Iverson et al., 2017; Sufrinko et al., 2019; Terry et al., 2022). For example, research has shown that athletes who suffer from migraines report more symptoms than athletes without migraine disorders in the first few days of their recovery following a concussion (Terry et al., 2021), which may influence their recovery trajectory. However, it is important to note that athletes with a history of migraines may perform worse on some aspects of SRC tests when at baseline (Moran et al., 2019). This means that athletes with a history of migraines may appear to fare worse after an SRC but, in reality, may not be scoring significantly worse than when in their healthy state. With that in mind, some post-SRC assessment considerations may be needed for athletes with a history of migraines to help determine when they have returned to their pre-injury state and can safely resume full activity (Moran et al., 2019).

With respect to recovery time, there is evidence to suggest that athletes with a history of migraines experience prolonged recovery times (Zemek et al., 2016). For example, a large study performed in Canada found that nearly 43% of youth with a history of migraines experienced prolonged symptoms compared to 28% of youth with no history of migraines (Zemek et al., 2016). Adding further support, a more recent study that compared recovery times from athletes (ages 12-23 years) with and without a history of migraines and found that athletes with a history of migraines took, on average, a week and a half longer to recover from their SRC (Kontos et al., 2020). One reason why these athletes may experience longer recovery times is that they are more likely to have sustained a past concussion, which may be associated with an increased risk of a prolonged recovery (Terry et al., 2018). This was exemplified in 1 study conducted on youth athletes, which found that 31% of athletes with a history of migraines had a history of SRC, while only 13% of athletes without a history of migraines had experienced a past SRC (Terry et al., 2018).

1.1.4 Neurodevelopmental disorders

The research focused on the role that neurodevelopmental factors, including learning disabilities and attention deficit hyperactivity disorder (ADHD), play in influencing SRC recovery times is limited. Of the research that does exist, the findings are mixed (e.g., Aggarwal et al., 2020; Cook et al., 2021). However, researchers have suggested that neurodevelopmental disorders may negatively impact SRC recovery outcomes (Aggarwal et al., 2020; McCrory et al., 2017; Miller et al., 2017). In particular, ADHD may be a risk factor for a prolonged SRC recovery in youth (Aggarwal et al., 2020). That said, it is important to recognize that athletes with neurodevelopmental disorders may have a greater SRC history, experience concussion-like symptoms more regularly in their

everyday lives and perform more poorly on SRC tests than athletes who do not have neurodevelopmental disorders, which may make these athletes appear to have worse recovery outcomes than they actually do (Iverson et al., 2017). Taking a comprehensive medical history is important so that practitioners may accurately assess for SRC and can create appropriate return to activity plans.

2. Modifiable factors

2.1 Rest and exercise

While cognitive and physical rest are typically recommended in the first 24 to 48 hours following a SRC (McCrory et al., 2017), rest beyond that initial period may have negative implications for an athlete's recovery and mental health (Grool et al., 2016; Lawrence et al., 2018; Lempke et al., 2019). For example, a study that looked at concussion recovery times in over 3000 children and youth found that physical activity within the first 7 days of injury was linked to a lower risk of PPCS (Grool et al., 2016). More recently, a Canadian study found that athletes who did not resume physical activity until 7 days post-SRC had nearly a 75% reduced probability of a faster recovery compared to those who resumed light physical activity 1-day post-injury (Lawrence et al., 2018). In other words, athletes who took longer to get active after their SRC had longer recovery times.

When returning to exercise after a concussion, it is important to consider the frequency, intensity, time and type of exercise (Lawrence et al., 2018) and to recognize that these variables will change as the athlete progresses through their recovery. As such, current best practices are to follow a gradual return-to-play (McCrory et al., 2017). This return to activity should avoid having athletes exercise too hard in the early stages of recovery, as strenuous exercise may exacerbate symptoms and result in a more complicated recovery (Eagle et al., 2020). During the return to play process, athletes should be careful to avoid situations where they could experience another concussion.

Similarly, in terms of cognitive rest, athletes should follow a gradual return-to-work or return-to-school protocol. An important component of cognitive rest may be to avoid excess screen time (Cairncross et al., 2022; Chrisman, 2021). Research indicates that those who limit screen time for 48 hours after a concussion have a lower SRC symptoms length by a median of 4 days (Chrisman, 2021), which could mean that athletes who limit screen time return to sport sooner. Overall, following return-to-activity guidelines and recommendations from health professionals could result in a faster recovery.

2.2 Seeking timely medical care

To help ensure that athletes receive the care and support they need following an SRC, they should seek medical attention (McCrory et al., 2017). An athlete may delay seeking medical care, for example, because they want to wait and see if their symptoms resolve on their own. However, waiting to seek medical care may increase the athlete's risk of a prolonged recovery (Eagle et al., 2020). This is because an athlete who delays seeking medical care may engage in activities, like resting too much or exercising too hard, if they do not get targeted support care for their symptoms, which can negatively impact their recovery (Eagle et al., 2020; Kontos et al., 2020).

A limited number of studies have explored how the time that it takes to seek medical care after a SRC influences recovery outcomes in athletes. However, the research that does exist suggests that athletes who do not seek medical care early in the recovery stages are more likely to have prolonged recovery times than those who seek timely care (Eagle et al., 2020; Kontos et al., 2020). For example, a recent study performed by Eagle and colleagues (2020) found that athletes who waited over 1 week to seek medical care after their SRC took approximately 8 days longer to fully recover than those who sought care within the first week. Another study found that athletes who received medical care within 1 week of their injury recovered on average 20 days earlier than those who waited 2 to 3 weeks to seek care (Kontos et al., 2020). Taken together, these studies demonstrate the importance of seeking timely medical care.

An important thing to note is that in some cases, an athlete's symptoms can take hours to appear after their SRC. It is called delayed symptom onset when symptoms take more than 3 hours to appear (Morgan et al., 2015). In the case of delayed symptom onset, athletes may be more likely to continue playing, putting themselves at risk of sustaining a secondary injury (Morgan et al., 2015). Additionally, researchers have found that athletes with delayed symptom onset are more likely to experience PPCS (Morgan et al., 2015). Repeated SRC assessments should be performed at different time intervals following a potential injury until a medical practitioner or sideline assessor can confidently rule out a SRC (McCrory et al., 2017).

2.2.1 Access to medical care

It is important to recognize that for some Canadian athletes, timely access to medical care is not feasible. Some athletes, particularly those living in rural and remote regions of Canada, face barriers (for example, living far from medical facilities) to accessing medical care after a SRC (Ellis & Russell, 2019). While researchers have identified that strategies such as telemedicine (virtual medical care) may be used to increase access to SRC care in rural and remote regions of Canada (Ellis & Russell, 2019), these methods are not

standard practice and require further refinement, particularly for the initial assessment and diagnosis of a concussion.

2.2.2 Concussion reporting and medical care

For athletes to seek medical care, they first need to report their SRC (Asken et al., 2016). Unfortunately, many athletes fail to report their SRC for reasons such as not wanting to let their team down or not recognizing that what they are experiencing is an SRC (Ferdinand Pennock et al., 2020). In fact, some studies have suggested that as many as two-thirds of athletes do not report an SRC (Sarmiento et al., 2017). This is a concern as athletes who do not report their injuries are at risk of sustaining a second concussion and a prolonged recovery or an even more severe brain injury (Asken et al., 2016).

With this in mind, there is a need for sport leaders and team medical trainers to emphasize the importance of concussion reporting to help ensure that athletes receive timely care. Research indicates that using safety narratives like "it will be better for you in the long run" when discussing concussion reporting can promote more positive concussion reporting behaviours (Corman et al., 2019). More simply, sport leaders can encourage concussion reporting by shifting concussion messaging to focus on the importance of reporting for athletes' long-term health and sport participation. Overall, when athletes report a concussion and seek the appropriate care promptly, they miss fewer practices and games (Kontos et al., 2020).

Additionally, to improve SRC reporting behaviours, coaches and other sport leaders should work to create environments where athletes feel supported and comfortable coming forward with information about SRC (Kim et al., 2018; Yeo et al., 2020). Research demonstrates that coaches play a large role in influencing athletes' reporting behaviours (Milroy et al., 2019; Sarmiento et al., 2017). For example, Milroy and colleagues (2019) found that student-athletes who had coaches who discussed SRC safety in a supportive manner were more likely to report SRC symptoms. Likewise, positive coach communication (meaning regular and supportive messaging) also appeared to foster more supportive cultures between athletes regarding SRC reporting (Milroy et al., 2019). With this in mind, coaches should work to have open and positive discussions about SRC with their athletes on an ongoing basis over the course of the sport season. To support coaches in these efforts, organizations should ensure that they are providing coaches with relevant and up-to-date SRC training and knowledge to ensure that the information coaches share with athletes reflects current best practices.

2.3 Social support

Research shows that SRC recovery can be difficult for many athletes (André-Morin et al., 2017). For example, after an SRC, athletes can experience psychosocial disruptions, including feelings of loneliness and depression (Bloom et al., 2022). These feelings may contribute to a more difficult recovery and, in turn, a longer time to return to sport post-injury (van Ierssel et al., 2022). Psychosocial disruptions may be exacerbated in athletes experiencing a prolonged recovery, which can further delay their recovery and lower their confidence to return to sport (van Ierssel et al., 2022).

An important factor for reducing the psychosocial impacts of SRC is social support (meaning support from others). A Canadian study exploring female athletes' experiences with SRC found that social support from coaches and team trainers played an important role in helping athletes during their recovery (André-Morin et al., 2017). In this study, researchers identified that some ways coaches can support athletes include checking in on them regularly throughout their recovery (for example, texting them to see how they are doing) and supporting them through all of the stages of the recovery protocol (for example, making sure they follow the proper return to sport protocols; André-Morin et al., 2017).

Social support from teammates has also been shown to help reduce some of the disruptions that athletes experience after a SRC (Covassin et al., 2017; Caron et al., 2021). Social support strategies that athletes received from teammates and identified as being helpful in one study included: (1) texting them regularly to see how they are doing, (2) offering to help them access support, and (3) advocating for their needs (Kita et al., 2020). However, in the same study, athletes suggested that they often don't receive enough support from teammates during their recovery (Kita et al., 2020).

To increase social support, there is a need to improve SRC education for all sport participants, including coaches and athletes (André-Morin et al., 2017; Kita et al., 2020). This is because in many cases, social support is not given due to a lack of knowledge about SRC and the return-to-play process (André-Morin et al., 2017). To be most effective, it may be beneficial for SRC education to be driven, at least in part, by those who have had a history of SRC and can provide practical recommendations for providing social support (Kita et al., 2020).

3. Summary and next steps

While most athletes will fully recover from their SRC in the month following their injury, there are cases where recovery may be prolonged. Prolonged recoveries can negatively affect athletes' mental health and well-being (Ledoux et al., 2022; Rice et al., 2018), not

to mention their athletic careers. Understanding what factors can positively and negatively contribute to an athlete's recovery can help inform more personalized recovery plans, ensuring that athletes receive all the support they need for a timely and safe return to sport.

Research demonstrates that an athlete's demographic factors may impact their recovery from an SRC (Iverson et al., 2017). For example, biological sex, age, race, neurodevelopmental disorders and a history of mental health challenges or a history of concussion may all contribute to a prolonged recovery (Iverson et al., 2017; McCrory et al., 2017; Ledoux et al., 2022; Zemek et al., 2016). Given that personal factors can alter recovery outcomes, SRC recovery plans must not follow a "one size fits all approach." Instead, the unique needs of individual athletes should be considered to ensure that the recovery plan addresses their needs and context. To that end, sports leaders should avoid comparing athletes' recoveries to one another, as each athlete will progress through the return-to-play process in their own time.

While demographic factors cannot be changed, the research presented in this review highlighted some important factors within the control of athletes, parents, coaches and other sport and healthcare professionals that may contribute to better recovery outcomes. For example, early SRC reporting, access to medical care, social support and following current best practice guidelines for SRC may all help athletes return to sport more quickly and safely (André-Morin et al., 2017; Eagle et al., 2020; Kontos et al., 2020). To ensure that athletes and the people that support them engage in these positive SRC behaviours, sports organizations are encouraged to provide all sports participants with up to date and evidence-based concussion education. Moreover, sports organizations should make SRC education and resources to support athletes in their recovery more accessible to ensure that all athletes can access the support that they need.

As highlighted in this review, there is a need for continued research to further understand how modifiable and non-modifiable factors contribute to an athlete's recovery outcomes. In particular, SRC recovery timelines need to be explored in more diverse populations. Researchers, medical and healthcare practitioners, and sport leaders should work collaboratively to identify how new research findings may be used to inform best practices around SRC recovery.

Takeaway points

- An athlete's biological sex, age, race and medical history may influence their recovery timeline after an SRC.
- Personalized recovery plans are warranted to help ensure that athletes do not return to sport too soon after an SRC.
- SRC reporting, seeking timely medical care and following return-to-play protocols can all help ensure that athletes get the supports they need to return to sport safely and promptly.
- Support from teammates and coaches can help reduce some of the emotional disturbances athletes face after an SRC, leading to less complicated recoveries.
- Increasing SRC education and awareness of proper return-to-play protocols are ways to help ensure that athletes receive the care they need as they recover.

Resources for Continued Learning

- [Concussion in sport policies](#)
- [Concussion in sport protocols](#)
- [Consensus statement for concussion in sport](#)
- [How biological sex and gender affect concussion risk and management](#)
- [Psychosocial readiness to return to sport following a sport-related concussion](#)
- [Sport Concussion Assessment Tool](#)
- [The 4 R's: Steps to a safe recovery](#)
- [You-CAN: Peers help youth athletes with concussions through education and social support](#)
- [PedsConcussion living guideline for pediatric concussion care](#)
- [Guideline for concussion- For adults over 18 years of age](#)

For more information or additional resources, visit the SIRC concussion hub at sirc.ca/concussion or contact the SIRC team at info@sirc.ca .

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