

Navigating concussion – community rugby players' experiences of a concussion management initiative in New Zealand

Rodrigo Costa, Danielle Salmon, Simon Walters & Marelise Badenhorst

To cite this article: Rodrigo Costa, Danielle Salmon, Simon Walters & Marelise Badenhorst (2024) *Navigating concussion* – community rugby players' experiences of a concussion management initiative in New Zealand, *Brain Injury*, 38:13, 1101-1112, DOI: [10.1080/02699052.2024.2376266](https://doi.org/10.1080/02699052.2024.2376266)

To link to this article: <https://doi.org/10.1080/02699052.2024.2376266>



© 2024 The Author(s). Published with license by Taylor & Francis Group, LLC.



Published online: 15 Jul 2024.



Submit your article to this journal [↗](#)



Article views: 542




View related articles [↗](#)



View Crossmark data [↗](#)

Navigating concussion – community rugby players' experiences of a concussion management initiative in New Zealand

Rodrigo Costa^a, Danielle Salmon ^{b,c}, Simon Walters ^a, and Marelise Badenhorst^a

^aSports Performance Research Institute New Zealand, School of Sport and Recreation, Auckland University of Technology, Auckland, New Zealand;

^bInjury Prevention and Player Welfare, New Zealand Rugby, Wellington, New Zealand; ^cPlayer Welfare and Rugby Services, World Rugby, Dublin, Ireland

ABSTRACT

Objective: Concussion is a serious concern in sport, with the potential to cause short- and long-term health consequences. These concerns highlight the need for the translation of concussion management guidelines into use in real-world sports settings. This qualitative study explores community rugby players' concussion experiences as part of New Zealand Rugby's concussion management pathway.

Methods: Semi-structured interviews were conducted with 36 rugby players (35 males and 1 female; 22 played at school and 14 at club-level; mean age 19.8 ± 4.8) Thematic analysis was utilized to analyze data.

Results: Four themes were identified i) the symptom journey, ii) the role of a dedicated concussion management pathway in shaping players' experiences, iii) the influence of coaches and physiotherapists, and iv) rugby culture. Support received as part of the concussion management pathway, and from individuals who were part of players' concussion journey, deeply impacted their overall experience. However, players identified insufficient guidance while returning to school/work. At times, the sport's collective cultural values made it difficult for players to enact positive concussion management behavior.

Conclusion: The findings highlight the importance of a defined management pathway to support players' recovery. Addressing negative aspects of rugby's collectivist culture remains critical for optimal concussion management and recovery.

ARTICLE HISTORY

Received 1 August 2023

Revised 17 May 2024

Accepted 30 June 2024

KEYWORDS

Concussion; qualitative descriptive; participant voice; coach; physiotherapist; health professional

Introduction

Concussions are complex injuries that can present a significant threat to the health and wellbeing of athletes (1). When not properly managed, concussions can lead to short- and long-term consequences for both physical and mental health (2–4). In recent decades, concussions and their resultant health effects have developed into a major media discussion point and a topic of focus throughout the sports industry (2). As a result, concussion awareness and management strategies for athletes have improved (5,6). However, despite improvements, concussion management programs in contact sports, particularly in the community setting, are lacking (7).

In contact sports, such as rugby union (henceforth rugby), it is highly likely that players will experience a concussion (8,9). A study conducted with former New Zealand (NZ) rugby players found that up to 92% of elite players, and 82% of community players believed they had sustained at least one concussion during their time playing rugby (10). In NZ, rugby is a popular sport with historical and cultural significance. The sport is played by approximately 177,640 men and women (NZR National Rugby Database, 2019), and accounts for 53% of all sports-related concussions in adults over 16 years of age – and 15% in children under 16, making concussion an extremely relevant national issue (11).

Past generations of rugby players may not have received adequate levels of concussion support (12,13). Improved understanding and awareness of the potential consequences of experiencing a concussion has led to increased efforts from sporting organizations to enhance the levels of support available for managing concussions. For example, significant efforts have been made in college athletics in the United States to optimize concussion management (14). Current policies require compliance with the National Collegiate Athletic Association (NCAA) Concussion Safety Protocol, which covers preseason athlete education, concussion diagnosis, injury management, and return to play guidelines (14). Implementation of these protocols has been shown to lead to improvements in concussion management, allowing athletes more time to recover and reducing the risk of repeat concussions during the recovery period (14). In Canada, the implementation of concussion guidelines have also been associated with improved awareness and concussion identification (15,16). The Canadian Guideline on Concussions in Sport provides a clinical framework and resources to assist in the evaluation and management of Canadian youth and adults suspected of having a concussion (17).

Following the 2016 International Conference on Concussion in Sport, NZ Rugby (NZR) increased investment in its concussion management program; as demonstrated

through the initiation of their concussion management pathway (CMP) (18). The CMP was designed to improve concussion management at the community level (clubs and schools). The first phase of the CMP comprises pre-season coach, player, parent and referee education sessions followed by player baseline testing (18). Once a suspected concussion is identified during training or match play, the incident is logged on a custom phone application (App), usually by either the team manager or physiotherapist. The App generates e-mail notifications to the player, their parents/caregivers, coaches, school/club and provincial rugby union (PU) containing information that a suspected concussion has occurred and what steps should be followed post-event. The e-mail to the player and parent contains a unique identifier code that allows a general practitioner (GP)¹ to access that player's baseline concussion scores through a secure web-based concussion portal that also provides guidance for diagnosis and clearance. When a diagnosis of concussion is made, e-mail notifications are again sent to relevant stakeholders. Thereafter, the player is required to follow a stand-down period, which includes adherence to graduated return-to-play and learn protocols (GRTP/L). After completion of the stand-down period, the player must visit the GP once more for medical clearance to return to contact training. A notification that the player has been cleared is then emailed to relevant stakeholders.

Achieving a better understanding of the physical and emotional experience of concussion injuries may assist in developing more player-focused management strategies (19,20). Qualitative research can help draw upon players' voice to provide deeper insight and improve the understanding of their injury experience (21). Although limited, the current literature which has studied players' perspectives has proven helpful in contributing to the overall contextual understanding of concussions in rugby. A study by Liston et al. (2018), found that players in general display a notable disregard toward the seriousness of concussions. A culture of denial toward the effects of concussions has been observed in other studies suggesting this is a common theme in rugby (13,22). These attitudes risk undermining the value and uptake of effective concussion management protocols.

Recent studies exploring player experiences in concussion management have focused on elite athletes (12,13). However, the majority of the rugby playing population participate at a community level. To better support athletes at this level, it is important to explore their perspectives around concussions and the management support they received. This player-focused study is part of a broader NZR concussion initiative, where at the end of the 2019 rugby season, semi-structured interviews were conducted to explore multiple stakeholders' perceptions of the CMP specifically. This project was conducted in three geographically and diverse provincial rugby unions (PU) in NZ. Within each PU, rugby administrators in schools and premier-level community clubs were contacted to identify high school and club teams, from which App managers (persons responsible for reporting suspected concussions), school contacts, coaches, players, nurses and parents were invited to participate in the study. This study focuses

specifically on the data representing the voice of the players. Therefore, the aim of this study was to explore players' experiences of concussion and the management support they received as part of NZR's CMP, to enhance the design and ongoing implementation of concussion management in NZ.

Materials and methods

Design

Part of a larger NZR concussion initiative (23), this study followed a pragmatic, qualitative descriptive approach (24,25). The aim of these descriptive accounts was to help inform future adaptations and implementation of the CMP and to enhance the care and support of players who have experienced concussion. Approval to conduct the research was obtained from the University of Otago Human Ethics Committee (approval 18/087). All participants provided informed written consent. For players aged 15 years or younger, written consent was also obtained from their parents/caregivers. Additional details regarding the design and data collection are contained in Appendix 1.

Data collection

Over the 2019 season, a total of 1454 players consented to participate in the CMP and completed a baseline assessment (males $n = 1273$; females $n = 181$). A total of 206 suspected concussions were reported post-season, 98 at club level and 108 at the high school level. For this study, we used purposive sampling to recruit players who had sustained a rugby-related concussion and followed CMP during the 2019 season. Of those players who consented to be interviewed ($n = 36$) post-concussion, all were logged in the App and reported during the season. The ideal pathway (completed a baseline assessment; concussion was logged in the App; attending a medical diagnosis; clearance assessment and returned to play) was followed by 83% ($n = 30$) of players and the remaining 6 missed at least one of the following (baseline, diagnosis or medical clearance assessment) during their concussion recovery journey. The stand-down period (SDP) differed between the three regions. In two of the regions, the SDP was 23 days for players under 19 (U19) and 21 days for players aged 19 and over (19+). One region had a reduced SDP for those players with valid baselines. The SDP was 19 days for U19 and 12 days for 19+ if players had completed a baseline, which aligned with current World Rugby guidelines. Conversely, if players had not completed a baseline, they adhered to the same SDP rules as the first two regions. For the 36 players in the study cohort 24 adhered to their respective union's recommended SDP, 2 had an extend SDP due to persistent symptoms, 3 players SDP was less than the recommended period, and SDP data were missing for 7 players.

Semi-structured interviews were held at a familiar location (i.e., school or rugby club) and time convenient to the participants. Interviews lasted between 35 and 75 minutes and were audio-recorded. Interview questions explored participants' experiences of concussion, as well as the various phases of the CMP. In total, 36 interviews were conducted with players, which consisted of 35 men's team players and 1 women's team player (Table 1).

Table 1. Player demographics ($n = 36$).

Demographic Variable		n
Age	Mean (SD)	19.8 (4.8)
	Range	14–32
Gender	Male	35
	Female	1
Ethnicity	New Zealand European	22
	Māori	1
	Pasifika	8
	Other	5
Playing level	High school	22
	Club	14
School decile ²	Low (1-4)	4
	Middle (5-7)	5
	High (8-9)	13
	Not applicable (Prem players)	14
Diagnosed with previous concussion	Yes	20
	No	14
	Missing	2
Total number of previous concussions	0	14
	1	10
	2	7
	3	1
	4	2
	Missing	2
Migraines or Headaches	Yes	9
	No	25
	Missing	2
Diagnosed with learning disorder	Yes	2
	No	32
	Missing	2

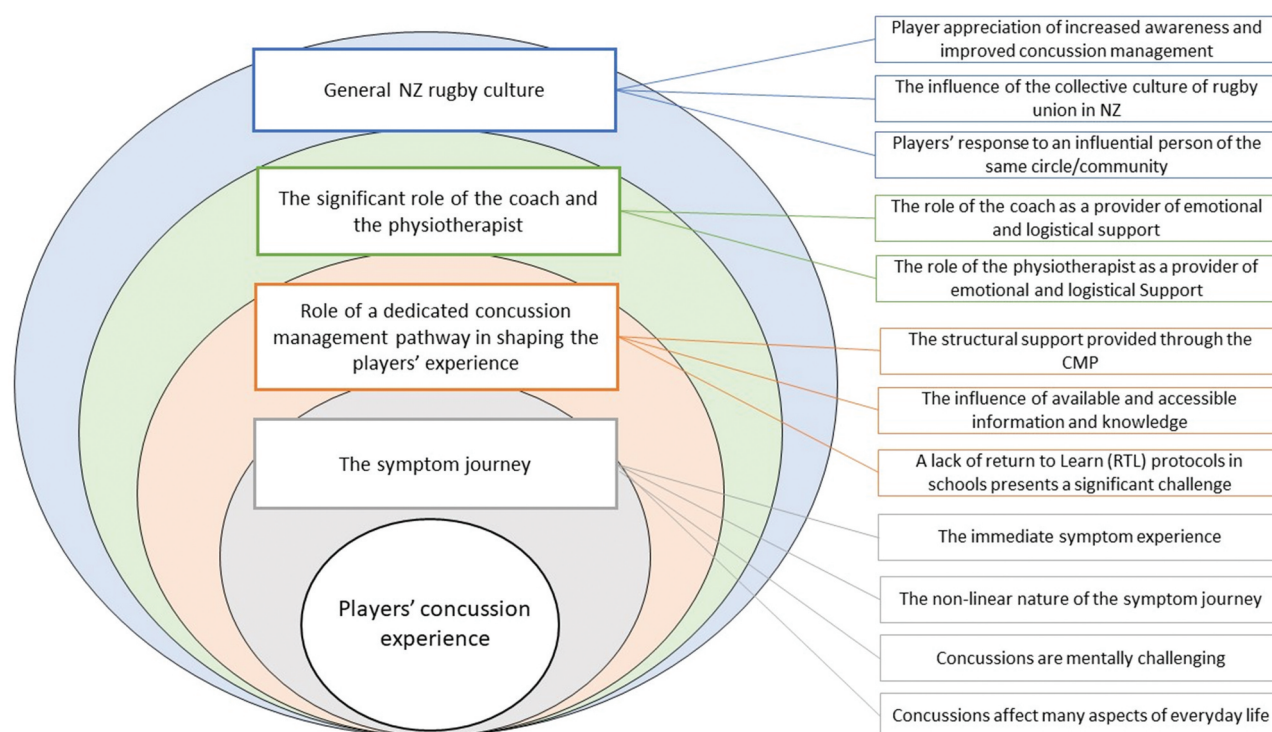
Analysis

Data was organized in NVivo (QSR International). We utilized a reflexive thematic analysis approach to analyze the data (26,27). More than one researcher was involved in the coding and analysis process. The inclusion of more than one researcher in the analysis process was not to gain consensus around meaning but was instead aimed at enabling a process that was collaborative, and that could facilitate the development of a rich exploration of the data (26,27). Familiarization of the data was undertaken by both (RC and MB). This process included reading each transcript and making notes about potential codes. Data was then coded inductively by RC and MB. Coding was discussed on a weekly basis. This process included an iterative discussion of each coder's codes and our understanding of the meaning contained in each code.

Codes with similar characteristics were merged to form categories by (RC), which were finally developed into themes. In line with a qualitative descriptive approach, the aim was to develop themes that stayed close to the data (25). In subsequent team meetings (all authors), themes were considered in relation to the coded extracts and the entire dataset. The aim of these discussions was to facilitate a comprehensive and well-considered description of the data. RC wrote the first draft of the findings, which was discussed and reviewed by the research team, informing the final analysis.

Results

Four themes describing players' experience of concussion and their progression through the CMP were developed from the data (Figure 1).

**Figure 1.** Themes and sub-themes related to players' concussion experience.

Theme 1; the symptom journey

The 'symptom journey' of the concussed rugby player was identified as a dominant theme playing a central role in influencing the players' overall injury experience. This theme consisted of four sub-themes i) the immediate symptom experience; ii) the non-linear nature of the symptom journey; iii) concussions are mentally challenging; iv) concussions affect many different aspects of everyday life. Illustrative quotes are contained in Table 2.

The immediate symptom experience

On the day of injury players reported experiencing a number of different neurological symptoms (including loss of consciousness, memory loss, dizziness, headaches, and fatigue). An issue that particularly concerned players was memory loss. Players were sometimes unable to recall the injury or certain things which happened before or after the injury (Quote 1 and 2). Suffering from memory problems, regardless of how brief this period lasted, was a traumatic and 'scary' experience for players as well as friends and family. Players described experiencing a sense of 'feeling lost,' 'confused,' and 'not quite right.' This sense of being lost, unaware of their surroundings and their situation, made players feel quite anxious (Quote 3).

The non-linear nature of the symptom journey

Delayed symptoms added to the complexity of the experience. Some players explained that they experienced minimal or no symptoms until hours, or even days after the injury (Quote 4). In some cases, the symptoms experienced would progressively worsen with time. The unpredictability of the symptoms, regarding duration and intensity, further added to the

confusion and anxiety. In some cases, players thought they were symptom free and 'finally recovered.' However, doing some form of either physical or mental effort would re-aggravate their symptoms (Quote 5). Some players reported still experiencing symptoms after being medically cleared (Quote 6).

Concussion is psychologically challenging

For some, experiencing a concussion was a psychologically traumatic experience which left doubt and 'fear' in the back of their minds; particularly when they had to face their first game or contact training (Quote 7). Players sometimes felt physically but not mentally ready (Quote 8). This fear naturally affected their game experience (Quote 9) and performance (Quote 10).

Concussion affects more than just rugby

The injury also negatively influenced various other aspects of participants' lives, such as school and work. Many players, who were playing high-school rugby, found that going back to school was difficult and that it was hard to concentrate in class (Quote 11). Older players who were returning to work also expressed that their lives were affected by concussion symptoms (quote 12)

Theme 2; the role of a dedicated concussion management pathway in shaping the players' experience

This theme described the role that the CMP played in players' concussion experience and consisted of 3 different sub-themes. i) the influence of available and accessible information and knowledge regarding concussion management and recovery;

Table 2. Theme 1; the symptom journey.

Sub-theme	Illustrative quote
1.1 The immediate symptom experience	<p>Quote 1: I was watching me play [on video replay] and I was like, 'what on earth?' Because I kept playing for like two, three, five minutes probably. I don't remember any of that and pretty much the second half ... So scary to think I don't remember that (Player 5).</p> <p>Quote 2: I didn't know what actually happened until I watched the video ... and the only thing I remember is waking up to was my mom crying (Player 12).</p> <p>Quote 3: All I remember was just coming out and just actually I saw stars for the first time, everything was just, I don't know, flashing ... And I was just like, 'what the f###? What do I do?' ... That's when (the Physio) ran over and was like 'Hey are you all right?' I was like, "I want to get off ... Because I was honestly, I got to the point where I was like, 'Am I part of this team?' (Player 16).</p>
1.2 The non-linear nature of the symptom journey	<p>Quote 4: Well, I didn't actually realize I had it, until the Monday. I played on Saturday, got a concussion, but I had delayed symptoms, most of them didn't kick in until midday on Sunday. Then, I just thought that I had burnt myself out from doing too much. However, like Monday morning came around, and I went to work, and I just wasn't feeling that good at all (Player 7).</p> <p>Quote 5: By Friday I thought I was pretty fine and then that happened (exerted himself physically) and it kind of reiterated it to myself that I was still actually concussed (Player 4).</p> <p>Quote 6: I still kind of have some side effects, I guess ... Probably need a little bit more (time) because I still get real tired and get confused quite a lot (Player 25).</p>
1.3 Concussion is psychologically challenging	<p>Quote 7: I was a bit scared I'm going to get knocked out again (Player 1).</p> <p>Quote 8: I felt I was ready, but pretty sure I was a bit scared ... I was a bit nervous to get tackled (Player 6).</p> <p>Quote 9: I wasn't playing as aggressive as I used to ... because I didn't want to get hurt (Player 3).</p> <p>Quote 10: I was like my reflexes were slow, pretty slow. I went in for a tackle, and I kind of froze. And I was, "What the f###? (Player 16).</p>
1.4 Concussion affects more than just rugby	<p>Quote 11: I just couldn't (concentrate), I literally, I would stare at a board and be like, seeing two of the board and then you'd be going off into a ... you know like a ... sort of like your own little world (Player 5).</p> <p>Quote 12: As soon as I had to start doing any thinking, I sucked. And I got a massive headache ... I actually had to apologize, because I was stumbling. I couldn't keep concentration. These people were like, you've asked me that three times (Player 18).</p>

Table 3. Theme 2; the role of a dedicated concussion management pathway in shaping the players' experience.

Sub-theme	Illustrative quote
2.1 The influence of available and accessible information and knowledge	<p><i>Quote 1:</i> I thought everything was explained to me really well once I did go through the concussion protocol stuff, like the steps and everything were really good. (Player 27).</p> <p><i>Quote 2:</i> That's why the visit was quite good because it was quite informative . . . I left with all the information that I felt I needed. (Player 31)</p> <p><i>Quote 3:</i> I do think I didn't really know what I was doing . . . I didn't get any e-mails or anything" (Player 5).</p> <p><i>Quote 4:</i> The form (written information handed to player after concussion) was good . . . because at the time you really don't remember much, because you've just had your head knocked (Player 18).</p> <p><i>Quote 5:</i> Having something in hand, like a piece of paper, would be helpful. Because specially with being concussed, I don't really remember much from the conversations I had on the day of injury and that first week in general (Player 7).</p> <p><i>Quote 6:</i> I could visualize what my return to play looked like and I got to see what stages I had to go through and stuff like that (Player 24).</p>
2.2 Structured support as a positive contributor to players' concussion experience	<p><i>Quote 7:</i> I had a really good experience, yeah. I think it's pretty cool how they're doing it . . . and how the whole concussion . . . they store data, I think that's pretty cool. Especially at our level as well, not just top levels (Player 31).</p> <p><i>Quote 8:</i> I think it was pretty good for the players. Because I had a couple of concussions [. . .] when I was playing in high school. Definitely the system, getting back to the game is better than that one. So, yeah it's like more clear and I am more confident just to get back in the game. So, I think it's good (Player 33).</p> <p><i>Quote 9:</i> The process felt safe and responsible. I felt like I've been taken care of. Not rushed back or held back . . . (Player 34).</p> <p><i>Quote 10:</i> I was mentally like . . . mentally satisfied. Like can relax because I was really nervous about my concussion because I had a headache, so . . . I think after meeting with the doc I was pretty relaxed (Player 33).</p>
2.3 A lack of Return to Learn (RTL) protocols in schools	<p><i>Quote 11:</i> I'm not sure about the school side of it, but I know that the sports like, well now that we're with like the concussion sort of side of it, they make us have a break from training and stuff like that . . . I didn't change anything for the school side of it, but obviously with . . . the rugby side of it (Player 24).</p> <p><i>Quote 12:</i> Maybe they should get a school thing as well, just to see what I should and shouldn't be doing? Because I'm not too sure. (Player 24)</p> <p><i>Quote 13:</i> I think in hindsight I probably should have just taken some time. I should definitely have taken some time off (Player 6).</p> <p><i>Quote 14:</i> I was a little bit lost. During school, my concussion . . . I couldn't like . . . see right, focus . . . (Player 14).</p> <p><i>Quote 15:</i> It was pretty hard to concentrate in class for the first week or so I went back to school . . . but yeah . . . (Player 10).</p> <p><i>Quote 16:</i> I was getting headaches . . . they just happened randomly (Player 11).</p>

ii) structural support as a positive contributor to a player's concussion experience; iii) a lack of Return to Learn (RTL) protocols in schools. Illustrative quotes are contained in Table 3.

The influence of available and accessible information and knowledge regarding concussion management and recovery

Information made available regarding concussion management had a strong influence on players' overall experience, providing players with clarity and guidance – something which was appreciated in what proved to be a complex and unpredictable injury. Many players reported being 'happy' and 'satisfied' with the information and guidance provided as part of the CMP (Quote 1).

Players particularly appreciated receiving useful information from medical professionals such as the GP and their physiotherapists (Quote 2), especially if they proved well informed and were able to explain information in a way that was easy to understand. In contrast, players who felt ill- or mis-informed, tended to have a more negative perception of their overall experience. Some players reported feeling 'confused and unsure' about their recovery process and had not, in their opinion, been provided with enough information and/or guidance (Quote 3).

The value of consistently providing tangible information in a physical form (such as a printed handout or an emailed

document) was clear (Quote 4) and was something which most players either appreciated or instead suggested as a way of improving their experience (Quote 5). Players reported particularly appreciating the 'recovery guidelines' – which explained the recovery goals and timelines that were necessary to complete in order to play again (Quote 6).

Structured support as a positive contributor to players' concussion experience

Players in general were satisfied with and appreciated the support provided by the CMP (Quote 7 and 8), which also made them feel safe and taken care of (Quote 9). A player explained that had it not been for the CMP and its educational impact, he 'would have probably lied' (Player 4) about experiencing symptoms and needing time off. The ability to attend a GP visit and receive clarity about their diagnosis helped to set players at ease (Quote 10).

A lack of return to learn (RTL) protocols in schools

One component of players' recovery that was reported as a distinct barrier was the actual implementation of the Graduated RTL (GRTL) protocol in schools. Players reported a supporting framework in place to guide their RTP but not for their RTL (Quote 11 and 12). Subsequently, most players underestimated the need to manage their RTL, and often rushed this process, because they were not properly informed

on the need for a graduated approach to learning activities. As such, many players mismanaged their concussion recovery – and consequently had an overall worse symptomatic experience. A number of players reflected that in retrospect, they should have taken some time off (Quote 13).

Many players returned to school while still suffering from concussion symptoms. Such symptoms include experiences such as ‘feeling lost’ (Quote 14), trouble focusing (Quote 15), or experiencing headaches (Quote 16). Sometimes, players felt their school would have supported them if they expressed the need to rest. However, players commonly placed pressure on themselves to return quickly.

Theme 3; the significant role of the coach and the physiotherapist

Coaches and physiotherapists were reported to provide emotional and logistical support and thus had a strong influence on players’ concussion experience. Illustrative quotes are contained in Table 4.

The role of the coach

Players remarked that coaches were capable of making them feel either pressured to play on – or supported in their need to rest and properly manage their injury. This pressure from coaches could be hard to handle, particularly if the player was younger or felt their position in the team may be threatened (Quote 1). Nonetheless, players often expressed high levels of respect and trust in their coaches.

Despite there being some coaches who exerted pressure on their players, in the majority of instances players felt coaches were ‘very supportive.’ Some attribute this support to improved general concussion awareness (Quote 2). Players particularly appreciated coaches who attended to both the emotional and logistical aspects of concussion management (Quote 3). Players also explained that coaches can positively influence an entire team environment. They can make everyone in that ‘inner community’ more supportive and understanding of the need to follow concussion

recovery protocol (Quote 4). Having clear rules set in place by a supportive coach was seen to help players deal with their concussion, both physically and mentally. Players expressed gratitude toward coaches who displayed such support, as it was hard as a player to *not* play, and in this sense, the coach ‘protected players from themselves’ (Quote 5).

The role of the physiotherapist

Players identified physiotherapists as playing an influential role in their concussion management journey. Physiotherapists were almost always the first to assess the players for symptoms, and to inform them on whether the player should come off or carry on playing. Post-match, when a suspected concussion was identified, it was the physiotherapist who often instructed the player to go and see a GP – to then begin the player’s recovery (process through which the physiotherapist acted as a line of communication between doctor and player) (Quote 6). Players appreciated the guidance and support provided by their physiotherapists during their recovery (Quote 7). Players often reported developing a strong, trusting relationship with their physiotherapist, and this provided the physiotherapist the opportunity to influence the player’s management (Quote 8).

Theme 4; rugby’s collective culture

This theme consists of three sub-themes: i) player appreciation of increased awareness and improved management of concussions; ii) the influence of the collective culture of rugby; iii) players’ response to an influential person of the same circle/community. Illustrative quotes are contained in Table 5.

Player appreciation of increased awareness and improved management of concussions

Players expressed appreciation for the recent improvements in awareness and management of concussions and that this positive change has provided them with better overall support and

Table 4. Theme 3; the significant role of the coach and the physiotherapist.

Sub-theme	Illustrative quote
3.1 The role of the coach	<p><i>Quote 1:</i> Yes, definitely (from) coaches ... they were kind of like, ‘you’ll be right.’ Yeah, and it’s hard to think otherwise, when you’re being told that, especially I think if you’re a younger guy, or if you felt pressure to keep your spot in the team (Player 30).</p> <p><i>Quote 2:</i> To be honest, obviously, with the whole awareness of it now. My coach and my management, as soon as I said I was feeling a bit dizzy, and faint sort of thing. They pulled me straight off. There was no, ‘Come on mate, you’ll be all right, carry on’ (Player 18).</p> <p><i>Quote 3:</i> He was just real supportive and ... Because yeah, I was quite upset and he was just real supportive and said lets follow the procedure and get you to a doctor. And he got hold of my mom and said to keep an eye on me and stuff (Player 29).</p> <p><i>Quote 4:</i> No one really worries too much about it, you know. It’s just, it happens. Everyone understands you can’t play. Coach won’t let you on, so it’s just like you carry on (with the recovery), you know ... (Player 16).</p> <p><i>Quote 5:</i> It’s just like human nature to just get back out there and just want to play ... but the coaches were really good, and they didn’t let anyone play unless they had a certificate (clearance letter)” (Player 6).</p>
3.2 The role of the physiotherapist	<p><i>Quote 6:</i> It was [physiotherapist name], came on and he just told me to stay put, and that he would get me off slowly and rang me later on that day just to check on me and stuff, just make sure I was doing alright and stuff. He booked me in for a GP a few days later ... he did step by step of what I needed to do to get back on the field. It was good (Player 35).</p> <p><i>Quote 7:</i> I thought it was really good, being able to talk it through with (team physiotherapist), who was talking to my GP in the clinic to get the diagnosis, clearance and stuff like that. That was really good. Like having someone who can monitor me through training (Player 27).</p> <p><i>Quote 8:</i> My last physio had been my physio for years, so while I was on the field she’d know something wasn’t right. And she knew what I was like, when I’d had a head knock and would know to ignore me if I got angry at her because she was trying to pull me off the field ... (Player 20).</p>

Table 5. Theme 4; Rugby's collective culture.

Sub-theme	Illustrative quote
4.1 Player appreciation of increased awareness and improved management of concussions	<p><i>Quote 1:</i> I like it because like, you know we're schoolboys, we're the next generation, I guess, so it's good that you guys are looking out for us now (Player 24).</p> <p><i>Quote 2:</i> I think a lot it's definitely improved over the past few years . . . Like my first year in the first XV, there was nothing. So it's changed a lot since then I think that will just continue to improve (Player 6).</p> <p><i>Quote 3:</i> I think the players are really supportive. The culture around the player alignment has changed a lot in the past years . . . everyone is much more understanding and reasonable (Player 30).</p> <p><i>Quote 4:</i> When my dad used to play rugby he said there wasn't anything like this so he thought it was good that there was people taking recognition of this kind of stuff rather than turn a blind eye. I guess there is a serious outcome if you don't take it seriously you might get it again and get permanent damage . . . (Player 19).</p> <p><i>Quote 5:</i> There's definitely been more awareness around it, but there can never (be enough) . . . probably chuck even more out there, sort of thing, about just the seriousness of concussions . . . But yeah. I think you guys do a pretty cool job" (Player 18).</p> <p><i>Quote 6:</i> It probably just, to make sure you listen. That's what I would do. I wish I had listened, because I feel, if I had listened I would have probably recovered a bit better. Because I never saw the importance of it (healing from a concussion), I was just, 'Ugh, you're just concussed.' Because when . . . thinking about it now, I used to just think that a concussion was just a one day thing, oh you're concussed the next day you're fine. . . But learning from doctors, that last meeting I had with them helped, it just opened my eyes . . . I told myself the next time I get concussed, I'm going to definitely going to do it properly (Player 16).</p> <p><i>Quote 7:</i> I feel bad, because we did have one guy on our team that just . . . he naturally just milks every injury. He got a concussion . . . But we did give him a lot of s### for milking it, sort of thing he was off for six weeks. But I do feel bad, because I got the concussion after that, and I thought, maybe this does hang around for a bit longer for some people . . . (Player 18).</p> <p><i>Quote 8:</i> I was pretty upset at the time, but I knew it had to be done (Player 10).</p> <p><i>Quote 9:</i> It's good to have a bit more recovery than you think . . . (Player 21).</p>
4.2 The influence of the collective culture of rugby union in NZ	<p><i>Quote 10:</i> We all want to be on the field no matter what. It sucks just watching the boys play, and then you're not part of it . . . (Player 16).</p> <p><i>Quote 11:</i> Hard to deal with, not playing. I found it hard just watching because it was a couple of weeks before I was allowed to play. And that was probably the hardest part, just watching (Player 19).</p> <p><i>Quote 12:</i> It was an important game . . . and we didn't have many players, this was a part where we had heaps of injuries and all that kind of thing . . . the whole team needs me kind of feeling (Player 5).</p> <p><i>Quote 13:</i> I could tell they (teammates) were disappointed and that sort of made feel that I wanted to (continue playing) . . . because it was big games for us and we wanted our strongest team playing, but they weren't pressuring me necessarily (Player 28).</p> <p><i>Quote 14:</i> I gave it a bit of a rub (player's head). And then they were on the verge of scoring, so I had to quickly try and get back in there, straight away, and then just deal with it . . . (Player 16).</p>
4.3 Players' response to an influential person of the same circle/community	<p><i>Quote 15:</i> That was pretty scary . . . he's a rugby player and you could actually be sick one day (Player 12).</p> <p><i>Quote 16:</i> Maybe try and find a story of a superstar, that didn't really follow the procedure, and just show that it happens to the best, so that they don't think we are all bulletproof . . . And yeah, just say that, to be at that elite level, you got to follow the steps (Player 16).</p> <p><i>Quote 17:</i> Someone that's been through it . . . and then just the effects of what could happen and how serious it is now compared to what it used to be . . . someone that is experienced in it and can speak some knowledge into them and I guess scare them a little bit . . . nothing to play around with (Player 17).</p> <p><i>Quote 18:</i> One of my mates is – Plays super rugby and he's had two years off footie (rugby) for head injuries, so talking to him. Told me a few things that screwed my head on right. . . I don't want to end up . . . Talked some sense into me a bit . . . (Player 17).</p>

care (Quotes 1 and 2). In some cases, players reported that their fellow teammates and parents were also more supportive and happy to see a change (Quotes 3 and 4). Players were grateful for what they perceived, in many instances, is becoming a more supportive and understanding rugby community and expressed desires to continue seeing such positive changes (Quote 5).

Some players explained that their past concussion management behavior was flawed. They appreciated what they had learnt while also demonstrating a desire for their concussions – as well as those of fellow rugby players – to be better cared for in the future (Quote 6). Some players also expressed regret at their past concussion-related attitudes, due to a lack of awareness and understanding (Quote 6 and 7). Several players revealed that they understood the need to take concussions seriously, and to take time off. Although it was hard to not play, and their initial reaction was possibly negative, they accepted and appreciated the need to take time off (Quote 8 and 9).

The influence of the collective culture of rugby union in NZ

Despite the positive attitudes toward concussion management, rugby culture appeared to still have a strong influence on some players' mentality, behavior, and willingness to sacrifice their own health for the team. Players explained that they did worry about their health and possible consequences of being concussed. However, they expressed a stronger desire to carry on playing – due to 'not wanting to let their team-mates down' or miss out on the sense of belonging and 'being with the boys' (Quote 10). Many players reported that watching and not being involved was emotionally tough to handle (Quote 11). For several players, the pressure to continue playing, or rush a recovery, came mostly from themselves. Often, this self-pressure stemmed from a feeling of wanting to help the team (Quote 12). This self-pressure was particularly strong if the injury happened during an important part of the game or season (Quote 13 and 14).

Players' response to an influential person of the same circle/community

Players explained that having someone that has played rugby and experienced a concussion can strongly influence their opinion and even potentially change the way they viewed, understood, and managed concussions. Part of the CMP involved attending an education session at the start of the season. Sometimes the talk was given by non-rugby players. Often, however, it was by either a current or former rugby player. When asked to reflect on which speaker was more influential (the former/past rugby player or the non-rugby player) players opted for the former. Players were more likely to be influenced by fellow rugby players who they felt they could relate to (Quote 15). One player explained that if it had not been for Sam Cane's (New Zealand Rugby's men's (All Blacks) team captain) educational talk at the beginning of the season he 'probably would have just lied [about his concussion], to be honest' (Player 4).

Players suggested that the current NZ Rugby CMP program would improve if more educational talks were to be given by current (or former) rugby players that people can relate to (Quote 16 and 17). Sometimes, the influential person responsible for changing concussion-related attitudes and behavior was a rugby player who was also a friend and not necessarily part of NZ Rugby's CMP (Quote 18).

Discussion

The aim of this study was to explore players' experiences of concussion, and the management they received as part of NZR's CMP. The findings identified that players' concussion experience was influenced by four interconnected themes: i) the symptom journey, ii) the role of a dedicated concussion management pathway, iii) the significant role of the coach and the physiotherapist, and iv) rugby's collective culture. Collectively, these findings suggest that the experience of concussion can be physically and mentally challenging, and may be influenced by multiple personal, interpersonal, organizational, and cultural factors.

On an individual level, the findings from this study described the symptomatic experience of concussions in rugby as both physically and mentally challenging for players. Players explained that concussion symptoms negatively affected not only their rugby but their normal activities of daily life, such as school and work. Other studies have similarly reported the substantial impact concussions can have on players' every-day functioning (19,28–31). Additionally, a lack of clear understanding and predictability of symptoms is a major characteristic of concussion injuries (32). As a result of these symptoms, players reported feelings of anxiety, frustration, and fear – all factors which may in turn, prolong symptoms and recovery (33). Although the majority of concussions should be resolved within 2 weeks, the recovery process is varying and dependent on multiple factors, including pre- or post-morbid conditions such as depression or migraine history (34,35). Detailed investigations into the influence of post-injury symptom severity on players' progression through the CMP are crucial in shaping the CMP for the future.

The findings of this study showed that concussions can be difficult to navigate regardless of duration and that structured support and guidance would be beneficial in this process. Concussion management strategies that include the education of coaches, parents and athletes; removal from play following a suspected concussion; and the requirement for medical clearance before return-to-play have been associated with a reduction in recurrent concussion rates (36). Conversely, continuing to play and delayed access to healthcare providers are associated with longer recovery after sustaining a concussion (36). Nonetheless, access to structured support remains a major barrier for athletes across different sports (28–31). In this study, most players reported appreciation for NZR's CMP. Players expressed gratitude for the improved support, understanding, and access to care, as well as the general cultural change which they felt the CMP had helped to create. Players also expressed a desire for continual improvement in the current concussion management support system. The findings also suggest that some players' past 'negative concussion management' behavior and attitudes were possibly the result of lack of knowledge and a structured management system. Such findings are significant, because they present a different side to the 'traditional, tough, masochist' stereotypical rugby player so often presented in the media and in research (37). It also stands in contrast to previous research which has suggested that rugby players, in general, limit the success of concussion management interventions due to an ingrained mind-set which actively dismisses and denies the seriousness of head injuries (12,13,22,37).

However, it was clear from the findings that some players still adopted unfavorable concussion management behaviors. Improved concussion awareness and knowledge, among key stakeholders, seemed to make it easier for players to acknowledge and care for their injuries while feeling supported by their rugby community. In contrast, the 'collectivist culture' was still apparent in rugby and made it difficult for some players to disclose and appropriately care for their injuries. These players showed a willingness to sacrifice their own health – and suppress their own fears and worries in order to help the team and be 'with the boys.' In a 'collectivist culture,' the individual is part of and belongs to something bigger than themselves (*the team*) (38). A disconnect between identifying and implementing best practice in rugby, and a culture which is supportive of the individual's sacrifice to play injured, display bravery, and disregard pain has been previously identified (22,37,39).

These qualities are often extolled in the NZ media, a typical example referring to All Blacks captain Richie McCaw's heroism in playing on in a World Cup final with broken bones in his foot ('Rugby: Former All Black Dan Carter reveals awe at witnessing Richie McCaw's World Cup grit – NZ Herald,' n. d.). Players may therefore sometimes feel that it is not socially acceptable to report a concussion and carry out the necessary precautions. Despite the positive findings related to player attitudes toward the CMP, players not wanting to let the team down, wanting to rush a recovery because they struggled not being with their teammates, or losing a sense of belonging, point toward the substantial influence of traditional dominant discourses that prevail in rugby. In addition, these factors remain a persistent challenge to best-practice concussion management (19,40).

Linked to the concept of collectivist cultures, players reported being more likely to listen to and be influenced by a member of their own community (i.e., someone who has, or still is, playing rugby). Players' felt that concussion was very specific, and thus only truly understood by someone from the same 'tribe.' Players reported that CMP education talks given by influential speakers proved extremely successful in generating positive change in attitude and behavior. Having an influential speaker, who is part of the rugby community and who has possibly even experienced success, can help generate positive cultural change through changing the beliefs of players. Influential speakers with powerful, real-world stories have the potential to positively affect behavior within their social networks (41,42). It has been suggested that concussion initiatives of the past have overly emphasized the individual, without focusing enough on community relationships and dynamics (41,43). Understanding players' experiences in this study helps us understand some of the reasons behind unfavorable behaviors. It also suggests that in rugby, cultural change and the use of influential role models has the potential to be an effective tool in driving favorable concussion behaviors – thus providing a clear target for future concussion management interventions. There is an opportunity to develop a culture in rugby that encourages players to support each other's health, developing the notion of 'brotherhood' as one of supporting and looking out for each other as opposed to playing on through pain to 'not let your mates down' (22).

Another key area of focus for CMP and future interventions is the provision of simple, relevant and targeted information. Some players were not properly informed or guided, and this influenced their overall experience. They explained that they either received little to no information – or that the information received was verbal and thus forgotten (particularly immediately post-injury). The consequence of this was that players felt unsure of what to do regarding their management and recovery. Printed information appeared to be a preferred resource for players. Research has repeatedly shown that information, or knowledge, on its own cannot generate behavioral change, especially with regard to concussion disclosure (41,44). Nonetheless, informed players may be better equipped (than non-informed players) to report concussions, and, importantly, to properly manage their recovery (45). In this study, information and awareness played a key role in players' experiences within the recovery phase and emphasizes the need to improve awareness, and continually provide clear, tangible, and updated information.

A particular component of players' experiences that stood out as a major area for future improvement is the actioning of the GRTL protocol in schools and to assist people to return to work. Concussion symptoms have been shown to interfere with the ability to complete school work and may be associated with reduced academic performance (30). GRTL guidelines have been established as a key component of concussion recovery (35). Guidelines recommend an initial period of relative rest (24–48 h), whereafter cognitive load may be increased incrementally if symptoms are not increased more than two points on a 1–10-point scale and being cautious of stimulants such as screens, light and noise (35,46). A GRTL protocol is available as part of the CMP. The challenge, however, is the translation of

the guidelines into practical steps within the school setting. Most players reported being unaware of whether their schools had any steps in place to implement GRTL policies. It appeared that schools display a supportive attitude toward concussion management in a *sport* setting. For example, schools guided and helped manage their students' RTP in rugby. However, these same schools would then fail to provide any structured guidance or support for the RTL process. Furthermore, players' attitudes also reflected a significant underappreciation of the need for rest and to take a graduated approach to RTL or work. Most players found it normal to simply return fully to school/work and push through whatever symptoms they experienced. This behavior, in turn, negatively contributed to the players' recovery and overall experience. The findings of this study point toward an urgent need for targeted strategies to assist schools with the implementation of RTL guidance (47). Schools have the potential to be a strong influence on players' attitudes and behaviors. Future research should explore why schools and players appear to prioritize physical recovery but underappreciate mental recovery. Few studies specifically report on real-world implementation of academic support (34,35). Research from the United States have reported the successful and feasible implementation of a student-centered, individually tailored return-to-learn plan in public high schools. However, in general, lack of policy, poor staff education and stakeholder communication breakdown appear to be persistent barriers to implementing RTL strategies in schools (48). Based on the need identified in our study, we have since used a community-based participatory action approach to develop a Framework for managing Concussion in New Zealand Secondary schools (FRANCS), to support the safe return-to-learn and activity of all students post-concussion (49). The framework aims to assist schools in bridging the gap between the existence of guidelines and the actual implementation of these guidelines in schools.

On an inter-personal level, this study found the coach to be a major influence on the players' concussion experience. Players felt that the coach's leadership style strongly influenced the overall culture of the team. As seen in other studies, coaches' approach and attitude toward concussion management affects the overall team culture (50,51). In rugby, the coach is often the leading figure on the team and therefore a primary influencer on the motivational climate created and the team's general attitudes, beliefs, and behaviors (52). In this study, players felt more confident in taking time off and adequately recovering when a coach showed sympathy and understanding. In contrast, players whose coaches demonstrated a less positive attitude toward concussion management and support found it much harder. A strong emphasis should be placed by organizations on educating coaches and in actively encouraging them to foster a culture which positively supports concussion management. Doing so can help to build a team culture in which players feel more physically and psychologically supported throughout their concussion experience and the many difficulties it provides (particularly the feeling of letting the team down, and on losing a sense of belonging).

In the past, it was common for players to carry on playing after suffering a concussion or to return to contact as soon as possible. Steve Thomson, a former professional rugby player for England, subsequently diagnosed with dementia, explains

that 'In the old days it was a bit of a laugh. If someone got whacked in the head, it was: *Oh, look at him, he's had a belt. He'll be up in a minute*' (53). At present, more than 150 former rugby players have filed a class-action lawsuit against governing bodies, alleging a failure to minimize risk. Media coverage in recent years has highlighted the concerning stories of some of these former rugby players. It is undeniable that optimal support and management of concussion should be a key priority of every union and team. A concern which this study highlights is the fact that players perceived CMP to be extremely beneficial when compared to what was previously available. Currently, the CMP is only being provided to schools and clubs who agreed to be part of the pilot programme; still leaving too many players without access to direct support. Notably, the translation and implementation of concussion guidelines in the community game is challenging. For example, an Australian community rugby union study reported that 78% of players did not receive return-to-play advice following a concussion, and of those who did receive advice, 100% still failed to comply with the 3-week stand-down period (54). Having a structured management process accompanied with targeted information and support may be an important aspect of improving compliance, as well as player experience.

It is concerning that even with the support provided via the CMP, the concussion experience of some players proved extremely challenging. This study strongly suggests it is therefore essential not only to continue support for interventions such as the CMP but also to find different ways to provide support for all members of the rugby community (particularly those identified as being less resourceful and more vulnerable). Research shows that concussions are better managed utilizing a multi-faceted approach (55). As it stands, GRTL/P protocols rest mostly on the principle of symptom guided gradual increase in activity or learning, based on symptom tolerance. Incorporation of additional concepts into a multi-modal approach, based on the players' needs and tailored accordingly, may provide a more holistic recovery experience. Such concepts may include vestibular and oculomotor rehabilitation; assessment, treatment and rehabilitation of cervical spine dysfunction; tailored low-level aerobic exercise and specific academic/work accommodations (55,56). When dealing with migraine headaches, sleep disturbances, mental health issues or cognitive difficulties, multidisciplinary medical management may be necessary (55). This may be particularly helpful for players whose symptoms persist for extended periods of time. Finally, concussions are not solely a NZ, nor rugby issue. Athlete experiences of concussion in other settings and sports can help shape context-sensitive interventions.

Limitations

A major limitation of this study is that only one women's rugby player was included. The original intention of the study was to recruit reasonably equal numbers of men's and women's rugby participants. However, due to logistical and timing issues, this was not possible. The women's season finished 4 weeks earlier than the men's season, which coincided with the end of term break, and meant it was difficult to recruit women's rugby players to participate. The number of women's teams involved in the study

was also significantly fewer than the men's teams (15% women's teams). Nonetheless, concussion rates in women's rugby are high and available resources and support are more limited (57). Although the female participant included in this study reported experiences similar to those of the male participants, the findings should not be considered to be reflective of female specific nuances in concussion management and experience. As the sport grows, it is necessary for future research to focus on understanding women's concussion experience to be better able to allocate resources and efforts into improving the game's safety for all players.

Conclusion

A clear and structured management pathway may assist in improved concussion management as well as much needed support for players. The positive change which players observed in this study supports the expansion of programmes such as the CMP. Targeted strategies to support players' return to school or work should be implemented. However, a structured management system for concussion is without value if players do not disclose their concussions. Addressing the negative aspects of rugby's collectivist culture remains critical for optimal concussion management and recovery.

Notes

1. Family doctor.
2. *Schools in NZ are ranked by deciles, which is a measure of the relative wealth of the area that the school serves.*

Acknowledgments

The authors acknowledge the support of the high schools and clubs for working with us and the players who volunteered to participate.

Disclosure statement

DS was employed by NZ Rugby during the conduct of this study.

Funding

Funding for this study as part of New Zealand Rugby's National Concussion Strategy was provided by World Rugby, the NZ Rugby foundation and the Accident Compensation Corporation through the RugbySmart program.

ORCID

Danielle Salmon  <http://orcid.org/0000-0003-1254-8308>
Simon Walters  <http://orcid.org/0000-0002-6467-4982>

References

1. Cunningham J, Broglio SP, O'Grady M, Wilson F. History of sport-related concussion and long-term clinical cognitive health outcomes in retired athletes: a systematic review. *J Athl Train.* 2020;55(2):132–58. doi: 10.4085/1062-6050-297-18. Cited in: PMID: 31935139.

2. Malcolm D. The impact of the concussion crisis on safeguarding in sport. *Front Sports Act Living*. 2021;3:42. doi: [10.3389/fspor.2021.589341](https://doi.org/10.3389/fspor.2021.589341).
3. Manley G, Gardner AJ, Schneider KJ, Guskiewicz KM, Bailes J, Cantu RC, Castellani RJ, Turner M, Jordan BD, Randolph C, et al. A systematic review of potential long-term effects of sport-related concussion. *Br J Sports Med*. 2017;51(12):969–77. doi: [10.1136/bjsports-2017-097791](https://doi.org/10.1136/bjsports-2017-097791). Cited in: PMID: 28455362.
4. Theadom A, Starkey N, Barker-Collo S, Jones K, Ameratunga S, Feigin V. Population-based cohort study of the impacts of mild traumatic brain injury in adults four years post-injury. *PLOS ONE* 2018;13(1):e0191655. doi: [10.1371/journal.pone.0191655](https://doi.org/10.1371/journal.pone.0191655). Cited in: PMID: 29385179.
5. Carter KM, Pahl AN, Christie AD. The role of active rehabilitation in concussion management: a systematic review and meta-analysis. *Med Sci Sports Exerc*. 2021;53(9):1835–45. doi: [10.1249/MSS.0000000000002663](https://doi.org/10.1249/MSS.0000000000002663). Cited in: PMID: 33787531.
6. Gupta A, Summerville G, Senter C. Treatment of acute sports-related concussion. *Curr Rev Musculoskelet Med*. 2019;12(2):117–23. doi: [10.1007/s12178-019-09545-7](https://doi.org/10.1007/s12178-019-09545-7). Cited in: PMID: 30887284.
7. Fraas MR, Burchiel J. A systematic review of education programmes to prevent concussion in rugby union. *Eur J Sport Sci*. 2016;16(8):1212–18. doi: [10.1080/17461391.2016.1170207](https://doi.org/10.1080/17461391.2016.1170207).
8. Owens TS, Rose G, Marley CJ, Calverley TA, Stacey BS, Williams P, Williams JP, Bailey DM. The changing nature of concussion in rugby union: looking back to look forward. *J Concussion*. 2019;3:205970021986064. doi: [10.1177/2059700219860641](https://doi.org/10.1177/2059700219860641).
9. Rafferty J, Ranson C, Oatley G, Mostafa M, Mathema P, Crick T, Moore IS. On average, a professional rugby union player is more likely than not to sustain a concussion after 25 matches. *Br J Sports Med*. 2019;53(15):969–73. doi: [10.1136/bjsports-2017-098417](https://doi.org/10.1136/bjsports-2017-098417). Cited in: PMID: 29530941.
10. Hume PA, Quarrie KL, Lewis GN, Theadom A. NZ-RugbyHealth study: self-reported injury experience and current health of former rugby union and non-contact sport players. *Sports Med*. 2022;52(7):1701–13. doi: [10.1007/S40279-021-01630-7](https://doi.org/10.1007/S40279-021-01630-7). Cited in: PMID: 35088235.
11. Theadom A, Starkey NJ, Dowell T, Hume PA, Kahan M, McPherson K, Kydd R, Feigin V, Barker-Collo S, McPherson K, et al. Sports-related brain injury in the general population: an epidemiological study. *J Sci Med Sport*. 2014;17(6):591–96. doi: [10.1016/j.jsams.2014.02.001](https://doi.org/10.1016/j.jsams.2014.02.001). Cited in: PMID: 24602688.
12. Daly E, White A, Ad B, Ryan L. Pressure. A qualitative analysis of the perception of concussion and injury risk in retired professional rugby players. *J Funct Morphol Kinesiol*. 2021;6(3):78. doi: [10.3390/jfmk6030078](https://doi.org/10.3390/jfmk6030078). Cited in: PMID: 34564197.
13. Daly E, Blackett AD, Pearce AJ, Ryan L. Protect the player, protect the game: reflections from ex-professional rugby union players on law changes, protective equipment, and duty of care in the professional game. *J Funct Morphol Kinesiol*. 2022;7(4):91. doi: [10.3390/jfmk7040091](https://doi.org/10.3390/jfmk7040091). Cited in: PMID: 36278752.
14. McCrea M, Broglio S, McAllister T, Zhou W, Zhao S, Katz B, Kudela M, Harezlak J, Nelson L, Meier T, et al. Return to play and risk of repeat concussion in collegiate football players: comparative analysis from the NCAA concussion study (1999–2001) and CARE consortium (2014–2017). *Br J Sports Med*. 2020;54(2):102–09. doi: [10.1136/bjsports-2019-100579](https://doi.org/10.1136/bjsports-2019-100579). Cited in: PMID: 31036562.
15. Damji F, Babul S. Improving and standardizing concussion education and care: a Canadian experience. *Concussion*. 2018;3(4):CNC58. doi: [10.2217/cnc-2018-0007](https://doi.org/10.2217/cnc-2018-0007). Cited in: PMID: 30652012.
16. Macartney G, Chen W, Vassilyadi M, Zemek R, Aglipay M, Macartney A, Lanos M, Goulet K. Effect of the parachutem awareness for players program on the acquisition of concussion knowledge and attitude in children who play soccer. *Can J Neurosci Nurs*. 2019;39:14–22.
17. Parachute. Canadian guideline on concussion in sport. Toronto. 2017.
18. Salmon D, Romanchuk J, Murphy I, Sullivan J, Walters S, Whatman C, Clacy A, Keung S, Van Der Vis K. Infographic. New Zealand rugby's concussion management pathway. *Br J Sports Med*. 2020;54(5):298–99. doi: [10.1136/bjsports-2019-100950](https://doi.org/10.1136/bjsports-2019-100950). Cited in: PMID: 31300392.
19. Seguin CM, Culver DM. The lived experience of sport-related concussion: a collaborative inquiry in elite sport. *J Appl Sport Psychol*. 2022;34(5):916–37. doi: [10.1080/10413200.2021.1998804](https://doi.org/10.1080/10413200.2021.1998804).
20. Donaldson A, Finch CF. Planning for implementation and translation: Seek first to understand the end-users' perspectives. *Br J Sports Med*. 2012;46:306–07. doi: [10.1136/bjsports-2011-090461](https://doi.org/10.1136/bjsports-2011-090461). Cited in: PMID: 22006931.
21. Bekker S, Bolling C, Oh A, Badenhorst M, Carmichael J, Fagher K, Hägglund M, Jacobsson J, Jm J, Litzky K, et al. Athlete health protection: why qualitative research matters. *J Sci Med Sport*. 2020;23(10):898–901. doi: [10.1016/j.jsams.2020.06.020](https://doi.org/10.1016/j.jsams.2020.06.020). Cited in: PMID: 32665215.
22. Salmon D, Badenhorst M, Walters S, Clacy A, Chua J, Register-Mihalik J, Romanchuk J, Kerr ZY, Keung S, Sullivan SJ, et al. The rugby tug-of-war: exploring concussion-related behavioural intentions and behaviours in youth community rugby union in New Zealand. *Int J Sports Sci Coach*. 2022;17(4):804–16. doi: [10.1177/17479541211047661](https://doi.org/10.1177/17479541211047661).
23. Salmon D, Sullivan J, Romanchuk J, Murphy I, Walters S, Whatman C, Clacy A, Keung S, Van Der Vis K. Infographic. New Zealand rugby's community concussion initiative: keeping kiwi communities RugbySmart. *Br J Sports Med*. 2020;54(5):300–01. doi: [10.1136/bjsports-2019-100949](https://doi.org/10.1136/bjsports-2019-100949). Cited in: PMID: 31302602.
24. Savin-Baden M, Major CM. Qualitative research: an essential guide to theory and practice. London: Routledge; 2013.
25. Sandelowski M. Focus on research methods: whatever happened to qualitative description? *Res Nurs Health*. 2000;23(4):334–40. doi: [10.1002/1098-240X\(200008\)23:4<334::AID-NUR9>3.0.CO;2-G](https://doi.org/10.1002/1098-240X(200008)23:4<334::AID-NUR9>3.0.CO;2-G). Cited in: PMID: 10940958.
26. Byrne D. A worked example of braun and clarke's approach to reflexive thematic analysis. *Qual Quant*. 2022;56(3):1391–412. doi: [10.1007/s11135-021-01182-y](https://doi.org/10.1007/s11135-021-01182-y).
27. Braun V, Clarke V. Reflecting on reflexive thematic analysis. *Qual Res Sport Exerc Health*. 2019;11(4):589–97. doi: [10.1080/2159676X.2019.1628806](https://doi.org/10.1080/2159676X.2019.1628806).
28. Valovich McLeod TC, Wagner AJ, Bacon CEW. Lived experiences of adolescent athletes following sport-related concussion. *Orthop J Sports Med*. 2017;5(12):232596711774503. doi: [10.1177/2325967117745033](https://doi.org/10.1177/2325967117745033).
29. Higgins L. Hope is not enough: my journey through concussion recovery. *Br J Sports Med*. 2022; bjsports-2022-106534. 57(3). doi: [10.1136/bjsports-2022-106534](https://doi.org/10.1136/bjsports-2022-106534). Cited in: PMID: 36424133.
30. Hodges A, Ameringer S. The symptom experience of adolescents with concussion. *J Spec Pediatr Nurs [Internet]*. 2019 [accessed 2 Mar 2021];24(4). doi: [10.1111/jspn.12271](https://doi.org/10.1111/jspn.12271). Cited in: PMID: 31497928.
31. Luff C. In-between the ears: how concussion reshaped my life. *Br J Sports Med*. 2020;54(23):1438–39. doi: [10.1136/bjsports-2019-101848](https://doi.org/10.1136/bjsports-2019-101848). Cited in: PMID: 32079602.
32. Giza C, Greco T, Prins ML. Concussion: pathophysiology and clinical translation. *Handb Clin Neurol*. 2018;158:51–61. doi: [10.1016/B978-0-444-63954-7.00006-9](https://doi.org/10.1016/B978-0-444-63954-7.00006-9). Cited in: PMID: 30482375.
33. Grubenhoff JA, Currie D, Comstock RD, Juarez-Colunga E, Bajaj L, Kirkwood MW. Psychological factors associated with delayed symptom resolution in children with concussion. *J Pediatr*. 2016;174:27–32.e1. doi: [10.1016/j.jpeds.2016.03.027](https://doi.org/10.1016/j.jpeds.2016.03.027). Cited in: PMID: 27079963.
34. Putukian M, Purcell L, Schneider KJ, Black AM, Burma JS, Chandran A, Boltz A, Master CL, Register-Mihalik JK, Anderson V, et al. Clinical recovery from concussion—return to school and sport: a systematic review and meta-analysis. *Br J Sports Med*. 2023;57(12):798–809. doi: [10.1136/bjsports-2022-106682](https://doi.org/10.1136/bjsports-2022-106682). Cited in: PMID: 37316183.
35. Patricios JS, Schneider KJ, Dvorak J, Ahmed OH, Blauwet C, Cantu RC, Davis GA, Echemendia RJ, Makkissi M, McNamee M, et al. Consensus statement on concussion in sport: the 6th

- international conference on concussion in sport-amsterdam, October 2022. *Br J Sports Med.* 2023;57(11):695–711. doi: 10.1136/bjsports-2023-106898. Cited in: PMID: 37316210.
36. Eliason PH, Galarneau J-M, Kolstad AT, Pankow MP, West SW, Bailey S, Miutz L, Black AM, Broglio SP, Davis GA, et al. Prevention strategies and modifiable risk factors for sport-related concussions and head impacts: a systematic review and meta-analysis. *Br J Sports Med.* 2023;57(12):749–61. doi: 10.1136/bjsports-2022-106656. Cited in: PMID: 37316182.
 37. Liston K, McDowell M, Malcolm D, Scott-Bell A, Waddington I. On being 'head strong': the pain zone and concussion in non-elite rugby union. *Int Rev Sociol Sport.* 2018;53(6):668–84. doi: 10.1177/1012690216679966.
 38. Hofstede G, Bond MH. Hofstede's culture dimensions: an independent validation using rokeach's value survey. *J Cross-Cult Psychol.* 1984;15(4):417–33. doi: 10.1177/0022002184015004003.
 39. Pringle R. Competing discourses - narratives of a fragmented self, manliness and rugby union. *Int Rev Sociol Sport.* 2001;35(4):425–39. doi: 10.1177/101269001036004004.
 40. Clacy A, Goode N, Sharman R, Lovell GP, Salmon PM. A knock to the system: a new sociotechnical systems approach to sport-related concussion. *J Sports Sci.* 2017;35(22):2232–39. doi: 10.1080/02640414.2016.1265140. Cited in: PMID: 27935422.
 41. Kerr ZY, Register-Mihalik JK, Haarbauer-Krupa J, Kroshus E, Go V, Gildner P, Byrd KH, Marshall SW. Using opinion leaders to address intervention gaps in concussion prevention in youth sports: key concepts and foundational theory. *Inj Epidemiol.* 2018;5(1):1–11. doi: 10.1186/s40621-018-0158-7. Cited in: PMID: 29984386.
 42. Walters SR, Minjares V, Bradbury T, Lucas P, Lenton A, Spencer K, Spencer S. Promoting a culture change in junior and youth sport in New Zealand. *Front Sports Act Living.* 2022;4. doi: 10.3389/fspor.2022.811603.
 43. Register-Mihalik J, Baugh C, Kroshus E, Kerr ZY, McLeod TC. A multifactorial approach to sport-related concussion prevention and education: application of the socioecological framework. *J Athl Train.* 2017;52(3):195–205. doi: 10.4085/1062-6050-51.12.02.
 44. Kroshus E, Baugh CM, Daneshvar DH, Nowinski CJ, Cantu RC. Concussion reporting intention: a valuable metric for predicting reporting behavior and evaluating concussion education. *Clin J Sport Med.* 2015;25(3):243–47. doi: 10.1097/JSM.000000000000137. Cited in: PMID: 25051193.
 45. Kay MC, Hennink-Kaminski H, Kerr ZY, Gildner P, Ingram BM, Cameron KL, Houston MN, Linnan LA, Marshall SW, Peck KY, et al. Factors and expectations influencing concussion disclosure within NCAA division I athletes: a mixed methodological approach. *J Sport Health Sci.* 2021. doi: 10.1016/j.jshs.2021.09.006. Cited in: PMID: 34547482.
 46. Broglio SP, Collins MW, Williams RM, Mucha A, Kontos AP. Current and emerging rehabilitation for concussion. A review of the evidence. *Clin Sports Med.* 2015;34(2):213–31. doi: 10.1016/j.csm.2014.12.005. Cited in: PMID: 25818710.
 47. Snedaker KP, Lundine JP, Ciccia AH, Haider MN, O'Brien KH. Gaps in concussion management across school-aged children. *Brain Inj.* 2022;36(6):714–21. doi: 10.1080/02699052.2022.2034954. Cited in: PMID: 35130810.
 48. Fetta J, Starkweather A, Huggins R, Van Hoof T, Casa D, Gill J. Implementation of return to learn protocols for student athletes with sport and recreation related concussion: an integrative review of perceptions, challenges and successes. *J Sch Nurs.* 2021;39(1):18–36. doi: 10.1177/10598405211056646.
 49. Salmon D, Badenhorst M, Keung S, Lucas P, Mossman K, Thompson K, Walters S, Sole G. Designing, implementing and evaluating a framework for managing concussions in New Zealand secondary schools: a study protocol. *N Z J Physiother.* 2023;51(3):S1–9. doi: 10.15619/nzjp.v51i3.276.
 50. Milroy JJ, Wyrick DL, Rulison KL, Sanders L, Mendenhall B. Using the integrated behavioral model to determine sport-related concussion reporting intentions among collegiate athletes. *J Adolesc Health.* 2020;66(6):705–12. doi: 10.1016/j.jadohealth.2020.01.027. Cited in: PMID: 32169526.
 51. Salmon D, Romanchuk J, Sullivan SJ, Walters S, Clacy A, Register-Mihalik JK, Kerr ZY, Whatman C, Keung S. Concussion knowledge, attitude and reporting intention in rugby coaches and high school rugby players. *Int J Sports Sci Coach.* 2021;16(1):54–69. doi: 10.1177/1747954120961200.
 52. Cruickshank A, Collins D, Minten S. Culture change in a professional sports team: shaping environmental contexts and regulating power. *Int J Sports Sci Coach.* 2013;8(2):271–90. doi: 10.1260/1747-9541.8.2.271.
 53. Bull A, Steve T. "I can't remember winning the world cup", England rugby union team | the Guardian [Internet]. 2020 [accessed 23 Jan 2023]. <https://www.theguardian.com/sport/2020/dec/08/steve-thompson-interview-world-cup-rugby-union-dementia-special-report>.
 54. Hollis SJ, Stevenson MR, McIntosh AS, Shores EA, Finch CF. Compliance with return-to-play regulations following concussion in Australian schoolboy and community rugby union players. *Br J Sports Med.* 2012;46(10):735–40. doi: 10.1136/bjsm.2011.085332. Cited in: PMID: 21705397.
 55. Schneider KJ. Sport-related concussion: optimizing treatment through evidence-informed practice. *J Orthop Sports Phys Ther.* 2016;46(8):613–16. doi: 10.2519/jospt.2016.0607. Cited in: PMID: 27477472.
 56. Schneider KJ. Concussion - part I: the need for a multifaceted assessment. *Musculoskelet Sci Pract.* 2019;42:140–50. doi: 10.1016/j.msksp.2019.05.007. Cited in: PMID: 31133539.
 57. King DA, Hume PA, Hind K, Clark TN, Hardaker N. The incidence, cost, and burden of concussion in women's rugby league and rugby union: a systematic review and pooled analysis. *Sports Med.* 2022;52(8):1751–64. doi: 10.1007/s40279-022-01645-8.