BMJ Open Sport & Exercise Medicine

Quest for clarity: investigating concussion-related responsibilities across the New Zealand Rugby Community System

Danielle M Salmon,[1,2] Jason Chua,[1,3] James C Brown ,[4,5] Amanda Clacy,[6] Zachary Yukio Kerr,[7] Simon Walters ,[2] Sierra Keung,[2] S John Sullivan,[1] Johna Register-Mihalik,[7] Chris Whatman,[2] Gisela Sole,[8] Marelise Badenhorst [2]

To cite: Salmon DM, Chua J, Brown JC, *et al*. Quest for clarity: investigating concussion-related responsibilities across the New Zealand Rugby Community System. *BMJ Open Sport & Exercise Medicine* 2023;**9**:e001722. doi:10.1136/bmjsem-2023-001722

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjsem-2023-001722).

Accepted 25 September 2023

Check for updates

© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to
Dr Marelise Badenhorst; marelise.badenhorst@aut.ac.nz

ABSTRACT

There is a growing concern around concussions in rugby union, at all levels of the game. These concerns highlight the need to better manage and care for players. However, consistency around concussion-related responsibilities of stakeholders across the community rugby system remains challenging. Taking a systems thinking approach, this pragmatic, qualitative descriptive study explored key stakeholder groups within New Zealand's community rugby system's perceptions of their own and others' concussion-related responsibilities. Participants included players from schools and clubs, coaches, parents, team leads and representatives from four provincial unions. A total of 155 participants (67 females and 88 males) were included in the study. Focus groups and individual interviews were conducted. Thematic content analysis was used to analyse data. Thirty concussion-related responsibilities were identified. These responsibilities were contained within four themes: (1) policies and support (responsibilities which influence policy, infrastructure, human or financial resources); (2) rugby culture and general management (responsibilities impacting players' welfare and safety, attitudes and behaviour, including education, injury reporting and communication); (3) individual capabilities (responsibilities demonstrating knowledge and confidence managing concussion, leadership or role/task shifting) and (4) intervention following a suspected concussion (immediate responsibilities as a consequence of a suspected concussion). The need for role clarity was a prominent finding across themes. Additionally, injury management initiatives should prioritise communication between stakeholders and consider task-shifting opportunities for stakeholders with multiple responsibilities. How concussions will realistically be managed in a real-world sports setting and by whom needs to be clearly defined and accepted by each stakeholder group. A 'framework of responsibilities' may act as a starting point for discussion within different individual community rugby contexts on how these responsibilities translate to their context and how these responsibilities can be approached and assigned among available stakeholders.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Although guidelines for managing concussion in the community are available, the real-world implementation of these guidelines remains challenging.

WHAT THIS STUDY ADDS

⇒ The community rugby system is complex, involving several important concussion-related responsibilities and multiple stakeholders across different system levels. Within this study, a lack of clarity around concussion-related responsibilities was evident and may lead to gaps in concussion care.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Clarity around these responsibilities and how they can be fulfilled in a rugby system could help to optimise concussion management. The findings of this study may serve as a foundation for other rugby communities to develop their context-sensitive concussion strategies with clearly delineated responsibilities and involved stakeholders.

INTRODUCTION

Between 2011 and 2019, on average, 6589 sports-related concussions were reported annually in New Zealand (NZ).[1] A growing body of evidence suggests that concussions may be associated with long-term symptoms and disability.[2–4] With the tendency for concussions to be under-reported and associated with delayed clinical management, the true burden of concussions may be far greater, highlighting concussions as a major concern to the public health system.[5] These concerns emphasise the need to translate evidence-based concussion management strategies into real-world sporting contexts, especially those with high risk of concussion, such as rugby union.[6–9]

Injury prevention and management strategies have shifted from linear approaches

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

towards more complex, multifactorial system-wide perspectives in recent years.[10 11] Rasmussen's Risk Management Framework (RMF) is a methodological approach that examines accident causation by considering stakeholders' actions at multiple system levels.[12] Research using this approach has identified that sports injuries and their management are influenced by factors not only in the immediate context of the incident but also by stakeholder groups' actions across multiple levels of a system (eg, schools, parents, managers and regulatory bodies).[11 13 14] Rather than focusing on the immediate environment surrounding the person who has sustained an injury, 'systems-thinking' aims to understand the network of systemic contributory factors involved in the injury. Thus, stakeholders' decisions and behaviours across different levels of a system should be considered when investigating opportunities for improved injury prevention and/or management.[11] This type of broader, context-specific and systematic approach to addressing athlete injury management has been recommended to create a culture that results in earlier identification and improved disclosure of concussions. As such, NZ Rugby (NZR) has developed and delivered a community-based concussion care initiative and concussion management pathway (CMP) that aims to improve concussion culture from injury prevention through to early intervention, management and return to play.[15 16] The NZR concussion strategy recognises that concussion awareness, education and management involve stakeholder groups at personal (eg, players and coach), interpersonal (team), community (eg, provincial union (PU), healthcare providers and schools), organisational (NZR) and policy levels (eg, NZ sport, World Rugby).

Although resources such as the International Consensus Statement on Concussion in Sport and World Rugby's community concussion guidelines are available, stakeholder attitudes and behaviours regarding the identification and treatment of concussions lack consistency.[17–20] Previous research in Australian community rugby specifically identified confusion around real-world, 'on-the-ground' concussion management responsibilities as an important challenge.[11 14] Examining these concussion management responsibilities in the NZR community rugby system as a collective may lead to a greater understanding of potential gaps in concussion management and facilitate the development of strategies to fill these gaps.[18 21] Therefore, this study explored key stakeholder groups within the NZ community rugby system's perceptions of their own and others' concussion-related responsibilities. A secondary aim was to develop a framework of concussion-related responsibilities as it applies to key stakeholders within the NZ community rugby system that may serve to enhance the current system and inform future concussion strategies in NZ and internationally.

METHODS

Design

This project is part of an ongoing evaluation of a CMP in community rugby in NZ. A pragmatic, descriptive qualitative study was conducted using semi-structured interviews and focus groups underpinned by Rasmussen's RMF.[12] Additional information regarding development of the interview schedule, data collection and analysis is contained in online supplement A.

Participants and data collection

Purposeful sampling was used to facilitate the inclusion of participants across different levels of the community rugby system.[11] The project was conducted in four geographically and socioeconomically diverse PUs in NZ to facilitate maximum variation in views. From this pool of PUs, we purposefully sampled male and female rugby playing schools and premier-level community clubs from a range of socioeconomic backgrounds. Club and school representatives were asked to recruit teams from which team leads, coaches, players and parents were invited to participate in the study. Additionally, PU representatives and NZR representatives involved in NZR's CMP within the four unions were invited to participate. 'Team leads' refer to those responsible for using the NZR phone application (App), allowing them to log concussions. These could be team managers, physiotherapists or coaches, depending on the team's preferences or resources. Role multiplicity was evident within certain stakeholder groups. For example, team leads were often also physiotherapists, but for this study, they were included in their capacity as team lead, irrespective of their professional backgrounds/responsibilities. Participants were thus enrolled according to their primary role in relation to the CMP. Written informed consent was obtained before the interviews and focus groups started. Focus groups and interviews followed a semistructured approach and were conducted by four experienced interviewers. The focus groups and interviews were audiorecorded, lasting 30–75 min. Twenty-eight focus groups (n=151) and four individual interviews were convened, comprising 155 participants (table 1). Individual interviews were conducted in instances where focus groups were not practically possible. Of the 93 players, 74 (80%) were high school players and 19 (20%) were club players. The sample represented 16 schools, 5 clubs, 4 PUs and NZR.

Analysis

Audio recordings were transcribed verbatim and imported into NVivo software (QSR International, V.1.5). Thematic content analysis was used to analyse data.[22] The analysis phase consisted of two separate steps to answer the research objectives.

Step 1: coding and development of a list of responsibilities

First, MB and JC independently coded the transcripts inductively to identify concussion-related responsibilities. Codes from the transcripts were organised

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 1 Demographic characteristics of stakeholder groups included in the study, based on their primary role in the NZR CMP (N=155)

Representative stakeholder groups	Age mean±SD (range)	Female n (%)
Coaches (n=7)	53±11 (41–75)	1 (14.3)
NZR representatives (n=2)	40±8 (34–46)	0 (0)
Parents (n=24)	45±6 (26–57)	13 (52)
Players* (n=93)	17±3 (13–26)	33 (35.5)
PU representatives (n=6)	46±17 (26–69)	2 (33.3)
Team leads (n=15)	30±11 (20–53)	12 (80)
School or club representatives (n=8)	38±10 (24–53)	6 (75)

*n=26 (28%) were diagnosed with a concussion in the 2018 rugby season.
CMP, concussion management pathway; NZR, New Zealand Rugby; PU, Provincial Union.

independently into preliminary categories representing the responsibilities discussed by participants. After that, in an iterative process, both researchers' preliminary categories were discussed among the research team and subsumed into a composite list of categories representing stakeholders' responsibilities. To further summarise the key responsibilities, we created a thematic map by grouping the categories into higher-order themes.

Step 2: developing a hierarchical framework of concussion responsibilities across NZ's community rugby system

In this stage, each transcript was revisited and deductively coded according to the categories in the responsibilities list. These responsibilities were labelled based on whether it was related to:

- Stakeholders' self-identified (perception of their responsibilities).
- Expected responsibilities (expectations of the responsibilities of other stakeholders).

These 'self-identified' and 'expected' responsibilities were collated according to the different levels of the hierarchical NZ community rugby system. During this process, it was indicated if any of the responsibilities within the stakeholder group were 'interwoven':

- Interwoven responsibilities were defined where agreement or overlap between self-identified and expected responsibilities for a single stakeholder were observed.

The hierarchical levels of this framework were adapted from previous research grounded in Rasmussen's RMF.[11–13 23] During the focus groups and interviews, participants referred to the responsibility expectations they had of additional stakeholder groups who were not interviewed in the current study. As such, the responsibilities of these stakeholder groups were still included in the framework but are labelled only as 'expected' responsibilities. Using an iterative process, the research team then explored the potential pressure points, gaps or inefficient replication of responsibilities that appeared to be present within this specific sample of a community rugby system.

Patient and public involvement

The public was not involved in the design of this research. The provincial rugby unions who agreed to participate in the study assisted with recruiting schools and clubs.

RESULTS

Step 1 results: concussion-related responsibilities

Thematic content analysis of the focus group data produced 264 preliminary categories (including duplicates). Refinement of these categories produced 30 categories representing stakeholders' responsibilities. The categories were diverse, from developing rugby policy to providing education and disclosing concussions on the field (table 2). Detailed descriptions are contained in online supplement B, table 1.

Four key themes describing the different responsibilities related to concussion management were identified from the 30 overarching content categories: (1) policies and support, referring to responsibilities which influence system-wide strategies or policy, infrastructure, human or financial resources; (2) rugby culture and general management, which refers to responsibilities impacting players' welfare and safety, buy-in, attitudes and behaviour, including education, injury reporting and communication; (3) individual capabilities, which refers to responsibilities that require knowledge, skills and confidence managing concussion, leading, enforcing protocols or role/task shifting and (4) intervention following a suspected concussion, concerning the responsibilities stakeholders assume as a consequence of a suspected concussion.

Step 2 results: hierarchical framework of concussion responsibilities across the community rugby system

The framework of concussion responsibilities across stakeholders that form part of the NZR community system is presented in table 3.

Level 1: responsibilities of the governing body (NZR)

The nature of the responsibilities identified was conceptually broader in scope compared with the lower levels of the community rugby system. NZR representatives described high-level governing responsibilities, including education, supporting players' welfare and safety, enforcing protocols and facilitating buy-in and favourable attitudes towards optimal concussion management (see table 2 for role definitions). Supporting and driving the delivery of educational programmes with respect to injury prevention and management was perceived as a key responsibility at this level. NZR representatives noted they were responsible for promoting a high-quality experience, described as a 'safe game culture'. With respect

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 2 Thematic map of concussion-related responsibilities as part of New Zealand Rugby's (NZR) CMP

Theme		Responsibility	Definition of responsibility	Illustrative quote
1	Policies and support	1.1 Develop and implement policy	To develop or implement policies, protocols or guidelines specific to concussion management.	'Yeah, I think too there needs to be a real, I suppose structure or system in place put in by the school just to outline what's your procedures.'—*Team lead*
		1.2 Resource provision and support	To provide human resources/trained personnel, or other forms of service or financial support.	'…if it's a player from one of the rep teams, you'll often find…that the manager or the coach will go out and you know, keep in contact with that person… but I just don't have the time or the resources…to do what I'd like to do.'—*PU representative*
2	Rugby culture, and general management	2.1 Support players' welfare and safety	To promote a safe game culture; oversee, lead or support actions related to general player welfare, health and safety.	'Within our organisation, we actually have a separate focus on safety and research but it all folds into quality of experience, the game has to be safe for it to be a quality experience or we have mutual interest with our Rugby Smart Division which looks after this.'—*NZR representative*
		2.2 Buy-in, attitudes and behaviour	To facilitate change by fostering buy-in for concussion-related initiatives, relationships and work towards developing favourable concussion attitudes and behaviours. Two sub-categories, 'team culture, trust and support' (eg, fostering trust) and 'compliance' (eg, adhering to the game rules) formed part of this category.	'…our community is four and a half million people, you know the All Blacks and our Black Ferns affect the general psyche of millions of people every weekend. We could be doing more to influence mum and dad, nana and granddad, uncle and aunty because they're the ones that influence our kids.'—*NZR representative*
		2.3 Communication between stakeholders	To act as a high-level conduit for information sharing and decision-making; facilitation of communication and action of communication between stakeholders to allow optimal concussion management; or to communicate one's medical history (eg, history of concussion and other injuries).	Parent A: 'need to make sure that the schools are doing the right thing by our children.' Parent B: 'Consistency.' Parent A: 'Yeah, consistency through all channels of rugby… So, if your kid goes to [school name] intermediate, plays junior rugby here, and he can't play for his club but then turns out for [school team name] on a Wednesday – ' Parent B: 'And plays, yeah.' Parent C: 'Cause he doesn't say anything.' Parent A: 'Yeah. So, is there a cross-communication? I mean that would be pretty hard but, how would you do that?'—*Parents*
		2.4 Injury reporting and administration	To report and record serious injuries utilising information systems within the rugby system.	'Primarily it is to actually be on the administrative end and that is to receive the serious injury reports around concussion injuries, so this is from all levels of rugby whether it's right at the top of the Magpies but say primarily during the club rugby season from club rugby senior grades of all levels, secondary schools right through all the grades and junior rugby as well…'—*PU representative*
		2.5 Education	To provide or support the delivery of concussion specific education initiatives.	'…like education with like all the players, coaches, managers and like blood pressure, like education that everyone has to, so everyone's on the same page…'—*Player*

Continued

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 2 Continued

Theme		Responsibility	Definition of responsibility	Illustrative quote
3	Individual capabilities	3.1 Knowledgeable about concussion	To be knowledgeable about concussion and concussion care (including the self-pursuit of self-education and the rules of the game pertinent to concussion (eg, stand down period).	'Well if your kids been concussed then you find out as much information as you can.'—*Parent*
		3.2 Knowledgeable about first-aid	To be knowledgeable and/or have the capability to act as a first responder in an accident.	'We do stipulate in our plan that all of the well there needs to be someone with(in] you routine that's trained in first-aid; they supply their own first-aid kits just because, we as competition managers aren't there on the day. Half the time we are, but half the time we are not so schools need to be self-sufficient.'—*PU representative*
		3.3 Authority and leadership	To demonstrate authority and leadership through decision-making, supervision and influence.	'…we set culture right from the outset of the field, or as soon as we drop the kids off, that's it until full time. They belong to the coaches, parents don't go on the field or make any decisions from the side-line, it was all the coach. They made the decision on play or not play.'—*Parent*
		3.4 Enforcing protocols	To monitor and enforce concussion protocols and consistency in management between stakeholders.	'Somebody [a player] dobbed in and said, 'if you have a concussion can you still trial for reps?' Like, you literally have a concussion—are you seriously asking this question? So the concussion happened on the Wednesday, he was knocked out cold, but the rep trials were on Saturday and it's not part of club rugby, so he can still trial right? …I just pulled rank and the mother abused me. And I'm like, 'you talking to me isn't going to change anything. He's not playing, he's not trialling, and if I see that he is trialling he will not be in the team."—*PU representative*
		3.5 Role multiplicity and task shifting	To take more responsibility and make more decisions if the actor primarily responsible for duty is unavailable.	'Well yeah like(a co-worker)and I last year were working with the physio; he's done so much stuff that he, just sort of took over that side [of responsibility). Just cause he had that obviously experience but, so and this year, having to make the decisions ourselves, yeah, it was challenging but a good idea.'—*Team lead*

Continued

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 2 Continued

Theme		Responsibility	Definition of responsibility	Illustrative quote
4	Intervention following a suspected concussion (in the context of the NZR Concussion Management Pathway)	4.1 Disclose	To tell someone about a suspected concussion, whether personally experienced or externally observed.	'…I'm forever reinforcing to them [players] about it's important to communicate to us as coaches, that if you get a head knock so that we can manage it, and so sometimes they're reluctant to say anything because they don't want to not play or they think they can't go back on.'—*Coach*
		4.2 Spot and recognise (awareness)	To be aware/alert to concussions, in self and others.	'Awareness that there could be an issue…so coaches are obviously out there, but they're watching the game; they need to be watching that [when] a players gone down, could there be a concussion issue? They don't necessarily have to know what to do, but they should be aware that something's going down and to call it.'—*Parent*
		4.3 Log concussion	To be responsible for logging concussions specifically via the CMP phone-based application.	Interviewer: 'Were you involved in logging it in or did your medics take care of that for you' Coach 1: 'It's my physio's job to log that in' Coach 2: 'Same our medic' Interviewer: 'And you're happy with them doing that?' Coach 2: 'Yip'—*Coach*
		4.4 Remove	To remove self or others from field following a suspected concussion.	'Oh you've just gotta pull the pin, you've just gotta go off I reckon'.—*Player*
		4.5 Stop game	To stop the game following a suspected concussion.	'Stop the game, like recognise what's happening and then deal with the situation.'—*Player*
		4.6 Use blue card	Referee issuing a blue card during game play as part of the game rules.	'If it's a blue card, which we have in senior club rugby and secondary school grades that have official referees here in [PU], is to make sure that the referees know what their responsibilities are as well.'—*PU representative*
		4.7 Acute medical management	To provide on-field medical support following a suspected concussion, including assessment of injuries, deciding if return to play is appropriate and diagnosing injuries.	'Being able to identify it on field when it happens… you're like firsthand, you're the first person sort of dealing with it in, like deal with it.'—*Team lead*
		4.8 Leadership and logistical management/coordination as part of acute incident	Where an actor undertakes a leadership role specifically in the acute phase of an injury. For example, delegating an actor's role, using authority to override other's decisions about return to play and undertaking the immediate coordination of care for the injured player	'My role [is] to remove them from the field, to monitor them and ask them questions and get some symptoms, and then I would definitely not let them back on and I'd communicate with their parents and encourage them to go and see a doctor.'—*Coach*
		4.9 Acute on-field support	To provide support on the field following a concussion incident, which includes supporting the coach and/or assisting with transferring duty of care (eg, following up with the injured player on the side-line).	'I think it's to take the duty of care away from the coach as quickly as possible, just out of a bit of respect for his, you know, amount of position and coaching… basically responsibility for your kid, that's what I'm trying to say.'—*Parent*

Continued

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 2 Continued

Theme	Responsibility	Definition of responsibility	Illustrative quote
	4.10 Diagnose	Providing a medical assessment of the player for a diagnosis of concussion.	'I went to the doctor and then that's when they like diagnosed it…'—*Player*
	4.11 Seek diagnosis and treatment	Advising players to seek medical help specifically following a suspected concussions.	'My coaches were the ones that said go to the doctor and get it checked out and one of my teammates, 'cause she'd been concussed earlier on in the year…'—*Player*
	4.12 Follow recovery protocol	Specifically following aspects of the gradual return to play and graduated return to learn protocols; to guide players through, or be an active participant (to action) in the GRTP and GRTL, treatment and individual rehabilitation.	'So as a player if you get a head knock, obviously, it's your role and responsibility to look after yourself and make sure you go through your proper steps. But like if you know you have a concussion make sure you get off the field and then following on from that doing what you need to do listening to the physio doing a rehab.'—*Player*
	4.13 Manage recovery process	Manage, oversee and coordinate the recovery and clearance process, ensuring the recovery protocol is followed, including training and medical clearance.	'… if someone has been concussed just go through the stats to get them back to play and try to take charge of that with the coaches. Organise the appropriate training around that time.'—*Team lead*
	4.14 Follow-up	The general actions of follow-up on player's diagnosis status, recovery and subsequent management, including players' progression through the CMP.	'Just ongoing monitoring because sometimes, stuff, just some of the mild stuff carries on for quite a while, even though it's mild…'—*Coach*
	4.15 Clearance	To seek or provide medical clearance as a prerequisite for players to return to play.	Coach: 'We had a few cases this year where we've had to send the boys ah suspected to send them to the medical to see the doctors' Interviewer: 'And they were diagnosed at that point?' Coach: 'No, they were cleared but we sent them through to just go through the process.'—*Coach*
	4.16 Quality of care	To deliver healthcare that is multidisciplinary and consistent in objective and optimal management.	'…our GP (general practitioner) refused to clear him [the player). She doesn't like rugby, she doesn't like people playing rugby and was not going put her registration at risk by clearing him…she went, '3 weeks! Minimum of 3 weeks!' …There was a knowledge deficit of hers but also her personal opinion clouded her professional judgement.'—*Parent*
	4.17 Responsible for Baseline testing	To conduct, champion and/or use baseline concussion assessment either before, or after a suspected concussion has occurred	'Interviewer: What roles and responsibilities does your child's coach have around concussions? Parent: um definitely the baseline testing would be the first educating the parents and the kids.'—*Parent*
	4.18 Use portal	To use a bespoke online website, which grants general practitioners access to players' baseline assessment, as part of NZR's CMP	My experience that I had with the testing was when I took one of my players to the medical and the doctor didn't use the website and he used his own tool. I can't remember what the form, was but yeah, so maybe there's no use of you having that base(line] test if the kids are not going to use it when they go to a medical.—*Coach*

CMP, concussion management pathway; GRTL, Graduated return-to-learn protocol; GRTP, Graduated return-to-play protocol.

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 3 Hierarchical representation of stakeholder groups and their responsibilities, which are the following: (1) interwoven responsibilities (self-identified responsibilities that appear to align with what is expected by others); (2) self-identified responsibilities (stand-alone) (additional self-identified responsibilities that are not reported as an expectation from others and thus not included as part of interwoven responsibilities) and (3) expected responsibilities (stand-alone) (additional responsibilities that others expect of a specific stakeholder but not identified by stakeholders themselves and thus not included as part of interwoven responsibilities) within the NZR community setting

Hierarchical level	Responsibilities			
Governing body	NZR			
	Interwoven: 1. Education 2. Player welfare and safety 3. Enforcing protocols 4. Buy-in, attitudes and behaviours	Self-identified (stand-alone): Develop and implement policy		Expected (stand-alone): 1. Communication between stakeholders 2. Resource provision and support
(2) Provincial unions, clubs and schools	Provincial Union Representatives	Schools		Clubs
	Interwoven: Injury reporting and administration Self-identified (stand-alone): 1. Education 2. Develop and implement policy 3. Follow-up 4. Communication between stakeholders 5. Clearance 6. Resource provision and support 7. Enforcing protocols 8. Buy-in, attitudes and behaviours 9. Player welfare and safety 10. Role multiplicity and task shifting Expected (stand-alone): No additional expected responsibilities	Interwoven: 1. Communication between stakeholders 2. Develop and implement policy Self-identified (stand-alone): Role multiplicity and task shifting Expected (stand-alone): 1. Concussion knowledge 2. Player welfare and safety 3. Authority and leadership 4. Manage recovery process 5. Injury reporting and administration 6. First-aid knowledge 7. Resource provision and support 8. Buy-in, attitudes and behaviours 9. Follow-up 10. Log concussion 11. Recognise		Interwoven: 1. Enforcing protocols 2. Resource provision and support 3. Player welfare and safety 4. Communication between stakeholders Self-identified (stand-alone): No additional self-identified responsibilities Expected (stand-alone): 1. Authority and leadership 2. Manage recovery process 3. Injury reporting and administration 4. Buy-in, attitudes and behaviours 5. Education
(3) Direct supervisors	Coaches	Parents	Physiotherapists	General practitioners*

Continued

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 3 Continued

	Interwoven: 1. Education 2. Buy-in, attitudes and behaviours 3. Authority and leadership 4. Leadership and logistical management/coordination as part of acute incident 5. Injury reporting and administration 6. Communication between stakeholders 7. Player welfare and safety 8. Role multiplicity and task shifting 9. Recognise 10. Remove Self-identified (stand-alone): 1. Follow recovery protocol 2. Manage recovery process 3. Follow-up 4. Enforcing protocols 5. On-field support 6. Seek diagnosis and treatment Expected (stand-alone): 1. Concussion knowledge 2. Acute medical management 3. Baseline testing 4. First-aid knowledge 5. Stop game	Interwoven: 1. Concussion knowledge 2. Player welfare and safety 3. On-field support 4. Recognise 5. Buy-in, attitudes and behaviour Self-identified (stand-alone): 1. Education 2. Communication between stakeholders 3. Seek diagnosis and treatment 4. Remove 5. Resource provision and support 6. Baseline testing Expected (stand-alone): 1. Enforcing protocols 2. Injury reporting and administration	Expected: 1. Manage the recovery process 2. Leadership and logistical management/ coordination as part of acute incident 3. Recognise 4. Acute medical management 5. Clearance 6. Follow recovery protocol 7. Follow-up 8. Concussion knowledge 9. Player welfare and safety 10. Authority and leadership 11. Log concussion 12. Enforcing protocols 13. Buy-in, attitudes and behaviours 14. Education	Expected: 1. Diagnose 2. Clearance 3. Concussion knowledge 4. Portal usage 5. Manage the recovery process 6. Follow-up 7. Quality of care 8. Authority and leadership	
(4) Stakeholders involved in acute concussion incident and recovery phase	Team leads	Wider team	Players	Referees*	Medics/undergraduate physiotherapy

Continued

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Table 3 Continued

	Interwoven: 1. Recognise 2. Remove 3. Manage the recovery process 4. Follow-up 5. Communication between stakeholders 6. Buy-in, attitudes and behaviours Self-identified (stand-alone): 1. On-field support 2. Acute medical management 3. Seek diagnosis and treatment 4. Role discomfort 5. Leadership and logistical management/coordination as part of acute incident 6. Role multiplicity and task shifting 7. Education 8. Baseline testing Expected (stand-alone): 1. First-aid knowledge 2. Use of blue card 3. Concussion knowledge 4. Report injuries 5. Authority and leadership	Interwoven: 1. Player welfare and safety 2. Buy-in, attitudes and behaviours 3. Injury reporting and administration 4. Communication between stakeholders Self-identified (stand-alone): Spot and recognise Expected (stand-alone): No additional expected responsibilities	Interwoven: 1. Buy-in, attitudes and behaviours 2. Player welfare and safety 3. Remove 4. Disclose Self-identified (stand-alone): 1. Injury reporting and administration 2. Seek diagnosis and treatment 3. Follow the recovery protocol 4. Concussion knowledge 5. Stop game Expected (stand-alone): No additional expected responsibilities	Expected: 1. Recognise 2. Leadership and logistical management/coordination as part of acute incident 3. Stop game 4. Remove 5. Concussion knowledge 6. First-aid knowledge 7. Player welfare and safety 8. Use blue card 9. Acute medical management 10. Authority and leadership 11. Injury reporting and administration 12. Buy-in, attitudes and behaviours	Expected 1. Recognise 2. Log concussion 3. Concussion knowledge 4. Leadership and logistical management/coordination as part of acute incident 5. Acute medical management

*Stakeholder not interviewed.
NZR, New Zealand Rugby.

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

to buy-in and attitudes, the focus was on the facilitation of these concepts among lower-level stakeholders. For example, NZR staff felt that part of their responsibility was influencing individuals to participate in educational programmes to change the game culture. Developing and implementing policy was described in the context of aligning strategic goals across different organisation sectors, such as game experience, safety and growth. Schools and PU reps at the local area government level also perceived this as a responsibility. However, their perception was more related to developing processes or policies specifically for concussion management within their schools or clubs.

Other participants' expectations of NZR's responsibilities were similar to the governing body's self-identified responsibilities. However, additional expectations were mentioned in communication between stakeholders and resource support, such as personnel resources and support for smaller schools and girls' teams.

Level 2: responsibilities of the PUs, schools and clubs

Overall, there was an imbalance between the high number of responsibilities (n=10) assumed by PU representatives and the responsibilities expected of schools (n=11) vs the interwoven responsibilities for these stakeholders (n=1 and n=2, respectively). Clubs, in general, were fulfilling expectations about their responsibilities in the rugby system. However, stakeholders expected additional responsibilities to those mentioned by club representatives to be fulfilled, such as authority and leadership, managing the recovery process and injury reporting.

PU representatives reported broad responsibilities, which included acting as a conduit for information sharing, influencing rugby culture and monitoring players' recovery from concussion (ie, following up with players and seeking evidence of medical clearance before returning to play). Their responsibilities also reflected those found at lower system levels, such as follow-up and clearance. PU representatives expressed discomfort with the extent (and uncertainty) to which they should follow-up with players to monitor their condition following a suspected concussion. No expected responsibilities were identified which were not being met by PU representatives.

A school representative (director of rugby) reported that his primary responsibility was facilitating communication between stakeholders and developing and implementing policy. However, stakeholders across the rugby system expected schools to undertake a broader range of responsibilities, essentially combining the responsibilities of PU representatives, clubs and responsibilities relevant to the intervention following a suspected concussion at the lower levels of the rugby system. Interestingly, the same school representative did not identify education as the school's responsibility and noted some discomfort with the amount of responsibility associated with this role.

Clubs undertook responsibilities closely tied to implementing concussion care (eg, ensuring the concussion protocol is adhered to following a concussion), communication between stakeholders, and generally supporting players' welfare and safety. Other stakeholders also expected clubs to be more active in other aspects, such as managing the recovery process, injury reporting, administration and education.

Both PU and the school representatives expressed role multiplicity and task shifting as one of their responsibilities, that is, to take more responsibility and make more decisions if the stakeholder primarily responsible for duty is unavailable.

Level 3: responsibilities of direct supervisors

Four stakeholder groups were presented at the direct supervisor level: coaches, parents, physiotherapists and general practitioners (GPs) (although only data on the 'expected' responsibilities of physiotherapists and GPs were collected). Across all framework levels, coaches held the greatest number of interwoven responsibilities (n=9) and the greatest number of self-identified, expected and interwoven responsibilities (n=20). Coaches identified and were expected to undertake a broad range of responsibilities from both a leadership and supervisory position, such as injury reporting, education, facilitating buy-in and attitudes and communication between stakeholders and responsibilities related to the acute concussion incident and recovery phase.

Participants shared the view that coaches played a role in intervening following a suspected concussion (eg, recognise and remove or stop the game), through to leadership and logistical management/coordination as part of acute incident (including medical management and being knowledgeable about first aid) and managing players' recovery. Unlike stakeholders at any other level of the rugby system, it was both self-identified and expected that coaches were adept at multiple roles and task shifting (one stakeholder assuming or alternating between different roles). Some coaches voiced uncertainty regarding the transfer of duty of care, that is, where their responsibility ends and to which point they should follow-up to ensure the player's welfare.

Generally, parents self-identified and were expected to be knowledgeable about concussion support, players' welfare and safety, and provide acute side-line support. Some parents also reported removing a player with a suspected concussion from the field was their responsibility.

Physiotherapists and GPs were expected to deliver clinically relevant responsibilities, such as acute medical management, diagnosis and clearance. However, compared with GPs, physiotherapists were expected to undertake a broader set of responsibilities that reflected their closer relationship with teams, such as on-field support, managing the recovery process, leadership and logistical management/coordination as part of the

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

acute incident, concussion recognition, recording injury details and following the recovery protocol.

Level 4: responsibilities of stakeholders involved in acute concussion incident and recovery phase

Five remaining stakeholder groups are represented at the level of persons involved in the acute concussion incident and recovery phase: team leads, wider team, players, referees and medics (first-aid personnel).

Team leads held a broad range of self-identified, expected and interwoven responsibilities, reflecting the multiple roles this stakeholder group assumed in the rugby system. For example, team leads also identified as physiotherapists, rugby medics or undergraduate physiotherapy students and non-medical staff (eg, school teachers) consequently meant that they had responsibilities which often overlapped with the leadership, team culture and acute injury management responsibilities held by the coach and other stakeholders with clinical backgrounds in the system—physiotherapists, medics and GPs. Medics, in particular, had expectations confined to the acute injury setting that were also duplicated by physiotherapists. Undergraduate physiotherapy students within the team lead group expressed uncertainty with identifying concussions on the field. Interestingly, players expected team leads to remove a player from the field before they got blue-carded so that they would not have to be subjected to the mandatory stand down period ('to have each other's backs').

The 'wider team' referred to participants' discussions of the team as a collective, thus including both players, coaches or team leads as a unit. Relative to other stakeholders in the system, participants noted fewer responsibilities for the wider team and players specifically (total n=5 and 9, respectively). Participants felt that the wider team, as a collective, had a role to play in creating a culture which supported players' welfare and safety, buy-in and attitudes, and actions that led to better concussion awareness, injury reporting and communication between stakeholders. It was a shared perception that players were responsible for disclosing concussions and being responsible for themselves or others during play. Players also felt that their responsibilities included communicating openly about their history of injury, seeking diagnosis and treatment, being knowledgeable about concussions and stopping the game. However, some players reported that it is up to the player to decide on the field whether what they are experiencing is serious enough to disclose (ie, assess their health and make their own decisions).

Stakeholders expected referees to take on a leadership position following a concussion, from early recognition to utilising game rules to support concussion care (eg, stopping the game, issuing a 'blue card') and acute medical management. However, some PU representatives felt that young, inexperienced referees could not be expected to have the same responsibility as experienced referees. Additionally, players felt it was the referee's responsibility to send the player off the field to be assessed for concussion but not necessarily give a blue card (which would result in a mandatory stand-down period during which the player is not allowed to return to playing rugby).

Considering the system as a whole

Considering these themes and the hierarchal representation of responsibilities by level in the community rugby system revealed areas of concern regarding role gaps or overlaps across levels. These areas of concern act as important recommendations for the future. For example, the need for clarity on specific stakeholder responsibilities was a prominent finding across aspects of injury reporting, education, facilitating attitudes, leadership, authority and various actions as part of the CMP. Additionally, aspects that may require future support included the following: ensuring communication within the system, finding support for and task-shifting opportunities for stakeholders with multiple responsibilities (including delegation or enhancing the role of parents), encouraging all stakeholders to prioritise concussion knowledge in themselves, building trusting relationships for the hand-over of duty of care, fostering positive player attitudes and beliefs around disclosure. A detailed description of these 'pressure points' is contained in Supplement B.

DISCUSSION

This study reported participants' perceptions of their own, and others' concussion-related responsibilities. The findings illustrated that some stakeholders have complex, interdependent and multidimensional responsibilities, which may be challenging to fulfil.

Concussion responsibilities and lack of clarity

This study identified 30 distinct responsibilities related to concussion management in community rugby (table 2). Our findings also suggest a lack of clarity with respect to 'who should be doing what', which may partly be explained by the sheer number of responsibilities and complexities identified within the community rugby system. The lack of clarity is consistent with previous work conducted in Australian rugby union and has important implications.[11 14] First, if several different stakeholder groups perceive that they are responsible for a specific task (eg, spotting for concussions, or educating players), it may serve to distribute the load and share the responsibility among stakeholders, which may contribute to efficiency in management. Indeed, some specific responsibilities should ideally be assumed across multiple stakeholders. One such example, 'supporting players' welfare and safety', was a prominent responsibility across multiple stakeholders and levels of the system. Conversely, overlap in responsibilities between stakeholders and the perception that someone else is also responsible may lead to certain actions related to that responsibility 'slipping through the cracks', as no designated person fully accepts the responsibility or ensures the task/duty

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

is executed or completed. This finding resembles the 'by-stander effect' in injury management, where the presence of several people in an injury situation have been shown to reduce the likelihood of an individual stepping in to help.[24] Overlapping responsibilities between stakeholders may also not be the most efficient use of human resources, which is not ideal for stakeholders with a long list of responsibilities. Second, these uncertainties may lead to a sense of anxiety if a stakeholder takes on multiple responsibilities (often across multiple levels of the system) because they are unsure if it will be taken care of by someone else. PU representatives, for example, described this as not knowing where their duty of care ended once a player was no longer in the rugby environment following a suspected concussion.

Lack of clarity may also lead to gaps in providing concussion care. For example, providing or supporting education about concussions was not identified as a responsibility related to schools. Yet, it was identified as a perceived role by PU representatives (at the same level of the rugby system as schools) and among other stakeholders in the levels above and below the school (ie, Regulatory Bodies and Associations; Direct Supervisors). These results suggest that full adoption of concussion care may be stymied by a lack of ownership for education and injury surveillance at some levels and fragmented adoption of the responsibilities pertinent to concussion care. Research conducted in occupational health has similarly highlighted the importance of clarifying responsibilities in managing employees' stress and mental health in the workplace.[25] Multilevel strategies that focus on improving education competency and translating evidence into practice among all those who care for concussed athletes should be investigated and encouraged.[7 8]

The need for additional support

Our findings suggest that some stakeholders and aspects of concussion management appear to require additional support. Although it is a positive finding that the importance of education and player welfare was reported at the higher levels of the system (levels 1 and 2), it appears that more tangible support and the presence of governing bodies are expected at lower levels (eg, human resource support for baseline testing, additional support in the flow of communication or general support for smaller schools and female rugby). Some stakeholders expressed discomfort with the extent of their responsibilities, and some were uncomfortable assuming responsibilities that they did not feel qualified for. Additionally, the findings suggest a high burden of responsibility, overlapping and multidimensional responsibilities assumed by coaches and team leads in the rugby system. For example, coaches and team leads had responsibilities that span the aspects of leadership through the acute management of concussion on-field and the subsequent recovery process.

PU representatives also perceived their responsibilities spanned from a collation of region-level injury surveillance data to direct follow-up with injured players and seeking confirmation of their medical clearance. Although not specifically interviewed as part of this study, physiotherapists have multiple responsibilities in the immediate management and recovery of players with concussion,[26 27] and this was also evident in the expectations of physiotherapists from the participants in this study. These findings demonstrate these stakeholders' broad influence on concussion care and its direct impact on players. This may also explain the discomfort team leads and PU representatives reported due to the multiple roles they have to assume. Additionally, our framework of responsibilities (table 3) suggests that currently, management of concussion recovery rests on the shoulders of the coach and team lead/physiotherapist, with potentially greater opportunities for schools, clubs and parents to have more involvement in the player's recovery process.[28]

Overall, the multidimensionality of stakeholders' responsibilities in the rugby system demonstrates stakeholders' ability (or need) to readily adapt to the capabilities and resources of stakeholders available from one community setting and level of the rugby system to another. Again, the flip side to this indirect approach may be that stakeholders' responsibilities may become implicit rather than explicit, resulting in duplication, miscommunication and inefficiencies in concussion care.

Of note, the participants in this study had multiple expectations from schools, which raises questions about the school's concussion-related responsibilities and whether schools are suitably resourced to fulfil all expected responsibilities. Similarly, clubs' capacity or resource constraints to provide education, resources for rehabilitation and optimal medical support should also be considered. In this sense, task shifting and role multiplicity may be unavoidable. Still, acquiring adequate knowledge and support structures for these stakeholders should be prioritised if we wish to not only enhance concussion care efficiency but also address the role discomfort reported by some stakeholders. Importantly, greater strides towards utilising other stakeholders, such as parents, could assist in this regard.[29] Moreover, school-based nurses can be valuable in many aspects of concussion care.[30] However, no specific role expectations of nurses were identified. The way these stakeholders can and should be actively engaged in the management system should be further investigated.

Implication for policy and practice

Within community rugby, there appears to be a gap between available guidelines and the real-world application of these guidelines.[11 20] This study has revealed that there is a need for the rugby community to actively engage in strategies that could bring clarity around concussion-related responsibilities. A framework that states which responsibilities are relevant to concussion care and who may be responsible, and how these responsibilities can be fulfilled in a rugby system could help optimise stakeholders' experience by aligning their expectations with their concussion responsibilities. 'Model of care' (MoC)

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

is one potential strategy that could help inform how these responsibilities are enacted in a local rugby system.[31] These system-strengthening approaches align sociopolitical, organisational, workforce and other health system characteristics to support the implementation of best practices. MoCs can be used as a facilitator to bridge the gap between evidence or guidelines for care delivery within a system by considering what to do and how to do it across each level of the system.[31] In the context of rugby-related concussion and trauma, injury outcomes are generally dependent on the resources available and carers' skills available at the specific time of care.[32] A systematic approach in the identification and subsequent management of players with concussions using an MoC approach could be one way to address the variability of concussion care delivered to rugby players in the community.

Apart from support for community rugby systems to recognise concussion symptoms and follow specific recovery guidelines, how concussions will realistically be managed in a real-world sports setting and by whom needs to be clearly defined and accepted by each stakeholder. The development of this 'framework of responsibilities' is intended as a starting point for discussion within different individual community rugby contexts on how these responsibilities translate to their context and, importantly, how these responsibilities can be approached and assigned among available stakeholders. Specifically, ensuring clarity around who is responsible for various concussion management responsibilities and identifying and supporting task-shifting opportunities are critical.

Future work should explore the engagement of other stakeholders that could alleviate some of the pressure experienced by stakeholders with multiple responsibilities. Parents appeared well positioned to play an active role in managing recovery and could provide additional support within the system.[29,33] However, stakeholders stepping into new roles should be adequately educated and supported.[34] It must also be remembered that knowledge alone does not predict behaviour.[35] Rugby has longstanding challenges with players and sometimes coaches and parents, placing performance above welfare (to win at all costs, not let the team down or be 'tough').[18,36] Even if clarity around responsibilities is achieved, enacting these responsibilities may still be restricted by unfavourable attitudes.[37,38] Thus, strategies that aim to facilitate a positive change in concussion attitudes should similarly remain a priority.

Limitations

The results of this exploratory study should be considered with its limitations in mind. First, due to practical constraints within the study design, not all stakeholders that could form part of concussion management in the community (eg, GPs) were interviewed as part of this study. However, participants referred to the responsibility expectations they had of GPs, and as such, these responsibilities were still included in the framework. Second, role multiplicity played a critical part in this study. For example, participants were classified according to their primary role in the team. Although some team leads were also physiotherapists, physiotherapists were not specifically represented as a primary stakeholder group. In this sense, role multiplicity likely affected participants' experiences, as a team lead who is also a physiotherapist may have more experience and knowledge in injury management compared with a team lead who is a teacher without medical training. Third, there were a limited number of school representatives in the current study, which may limit the transferability of the results more broadly across the school context. Further research is recommended to evaluate the transferability of the study findings in different cultural and sporting contexts.

CONCLUSION

The community rugby system is complex, involving several important concussion-related responsibilities and multiple stakeholders across different system levels. A context-sensitive approach to clarification of responsibilities is needed to facilitate optimal concussion management. Stakeholders need clarity around their concussion responsibilities, and more support is needed for those with multiple responsibilities. The findings of this study may serve as a foundation for other rugby communities to develop their context-sensitive concussion strategies with clearly delineated responsibilities and involved stakeholders.

Author affiliations
[1]Safety and Welfare, New Zealand Rugby, Wellington, New Zealand
[2]Sports Performance Research Institute New Zealand, Auckland University of Technology, Auckland, New Zealand
[3]Department of Psychology and Neuroscience, Auckland University of Technology, Auckland, New Zealand
[4]Carnegie Applied Rugby Research (CARR) Centre, Carnegie School of Sport, Leeds Beckett University, Leeds, UK
[5]Institute of Sport and Exercise Medicine, Department of Exercise, Sport and Lifestyle Medicine, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
[6]School of Law & Society, University of the Sunshine Coast, Maroochydore, Queensland, Australia
[7]Department of Exercise and Sport Science, University of North Carolina, Chapel Hill, North Carolina, USA
[8]School of Physiotherapy, University of Otago - Dunedin Campus, Dunedin, New Zealand

Twitter Johna Register-Mihalik @johnamihalik and Marelise Badenhorst @physiomb

Contributors DMS, JC, AC, SW, SJS and MB were involved in the conceptualisation of the manuscript. MB and JC were responsible for coding of the data. All authors were involved in the interpretation of the results. MB, JC and DMS wrote the first draft of the manuscript. DMS and MB are study guarantors. All authors were involved in editing drafts of the manuscript.

Funding This work was supported by funding from World Rugby, the New Zealand Rugby Foundation and the Accident Compensation Corporation through the RugbySmart programme. The funders were not involved in the design of the study, data collection, analysis or interpretation of data, in the writing of the report, or in the decision to submit the article for publication.

Competing interests During the course of the study, DMS and JC were employed by NZ Rugby.

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and ethical approval was granted by the University of Otago Human Ethics Committee (approval 18/087). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Data are in the form of digital voice recording, which have been transcribed verbatim. Voice recordings contain identifiable data and will not be made available. Deidentified transcriptions may be made available on reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iDs

James C Brown http://orcid.org/0000-0002-7778-7783
Simon Walters http://orcid.org/0000-0002-6467-4982
Marelise Badenhorst http://orcid.org/0000-0001-8443-9173

REFERENCES

1 ACC Analytics & Reporting. *Accident Compensation Corporation Concussion / TBI Data - Dataset - data.govt.nz - discover and use data*. 2021. Available: https://catalogue.data.govt.nz/dataset/acc-concussion-tbi-data
2 Theadom A, Starkey N, Barker-Collo S, *et al*. Population-based cohort study of the impacts of mild traumatic brain injury in adults four years post-injury. *PLoS One* 2018;13:e0191655.
3 Manley G, Gardner AJ, Schneider KJ, *et al*. A systematic review of potential long-term effects of sport-related concussion. *Br J Sports Med* 2017;51:969–77.
4 Iverson GL, Castellani RJ, Cassidy JD, *et al*. Examining later-in-life health risks associated with sport-related concussion and repetitive head impacts: a systematic review of case-control and cohort studies. *Br J Sports Med* 2023;57:810–24.
5 Ferdinand Pennock K, McKenzie B, McClemont Steacy L, *et al*. Under-reporting of sport-related concussions by adolescent athletes: a systematic review. *International Review of Sport and Exercise Psychology* 2020:1–27.
6 Malcolm D. The impact of the concussion crisis on safeguarding in sport. *Front Sports Act Living* 2021;3:589341.
7 Donaldson A, Newton J, McCrory P, *et al*. Translating guidelines for the diagnosis and management of sports-related concussion into practice. *Am J Lifestyle Med* 2016;10:120–35.
8 Schneider KJ, Patricios JS. International consensus on concussion in sport: calling clinicians to action *Br J Sports Med* 2023;57:615–6.
9 Van Pelt KL, Puetz T, Swallow J, *et al*. Data-driven risk classification of concussion rates: a systematic review and meta-analysis. *Sports Med* 2021;51:1227–44.
10 Bittencourt NFN, Meeuwisse WH, Mendonça LD, *et al*. Complex systems approach for sports injuries: moving from risk factor identification to injury pattern recognition - narrative review and new concept. *Br J Sports Med* 2016;50:1309–14.
11 Clacy A, Goode N, Sharman R, *et al*. A knock to the system: a new sociotechnical systems approach to sport-related concussion. *J Sports Sci* 2017;35:2232–9.
12 Rasmussen J. Risk management in a dynamic society: a modelling problem. *Safety Science* 1997;27:183–213.
13 McLean S, Finch CF, Goode N, *et al*. Applying a systems thinking lens to injury causation in the outdoors: evidence collected during 3 years of the understanding and preventing led outdoor accidents data system. *Inj Prev* 2021;27:48–54.
14 Clacy A, Goode N, Sharman R, *et al*. A systems approach to understanding the identification and treatment of sport-related concussion in community Rugby Union. *Appl Ergon* 2019;80:256–64.
15 Salmon D, Sullivan J, Romanchuk J, *et al*. Infographic. New Zealand Rugby's community concussion initiative: keeping Kiwi communities Rugbysmart. *Br J Sports Med* 2020;54:300–1.
16 Salmon D, Romanchuk J, Murphy I, *et al*. Infographic. New Zealand Rugby's concussion management pathway. *Br J Sports Med* 2020;54:298–9.
17 Donaldson A, Finch C. Planning for implementation and translation: seek first to understand the end-users' perspectives. *Br J Sports Med* 2012;46:306–7.
18 Salmon DM, Badenhorst M, Walters S, *et al*. The Rugby tug-of-war: exploring concussion-related behavioural intentions and behaviours in youth community Rugby Union in New Zealand . *International Journal of Sports Science & Coaching* 2022;17:804–16.
19 Piedade SR, Hutchinson MR, Ferreira DM, *et al*. The management of concussion in sport is not standardized. A systematic review. *Journal of Safety Research* 2021;76:262–8.
20 Hollis SJ, Stevenson MR, McIntosh AS, *et al*. Compliance with return-to-play regulations following concussion in Australian schoolboy and community Rugby Union players. *Br J Sports Med* 2012;46:735–40.
21 Salmon DM, Mcgowan J, Sullivan SJ, *et al*. What they know and who they are telling: concussion knowledge and disclosure behaviour in New Zealand adolescent Rugby Union players. *J Sports Sci* 2020;38:1585–94.
22 Bengtsson M. How to plan and perform a qualitative study using content analysis. *NursingPlus Open* 2016;2:8–14.
23 Salmon PM, Goode N, Taylor N, *et al*. Rasmussen's legacy in the great outdoors: a new incident reporting and learning system for led outdoor activities. *Appl Ergon* 2017;59(Pt B):637–48.
24 Fischer P, Krueger JI, Greitemeyer T, *et al*. The bystander-effect: a meta-analytic review on bystander intervention in dangerous and non-dangerous emergencies. *Psychol Bull* 2011;137:517–37.
25 Schmidt S, Roesler U, Kusserow T, *et al*. Uncertainty in the workplace: examining role ambiguity and role conflict, and their link to depression-a meta-analysis. *European Journal of Work and Organizational Psychology* 2014;23:91–106.
26 Reid DA, Hume P, Whatman C, *et al*. Knowledge, attitudes, and behaviours of New Zealand physiotherapists to sports-related concussion. *NZJP* 2020;48:19–28.
27 Maxtone S, Bishop M, Chapple C, *et al*. Physiotherapist involvement in concussion services in New Zealand: a national survey. *NZJP* 2020;48:70–9.
28 Anderson D, Gau JM, Beck L, *et al*. Management of return to school following brain injury: an evaluation model. *Int J Educ Res* 2021;108.
29 Register-Mihalik JK, Williams RM, Marshall SW, *et al*. Demographic, parental, and personal factors and youth athletes' concussion-related knowledge and beliefs. *J Athl Train* 2018;53:768–75.
30 Weber Rawlins ML, Snedden TR, Kay MC, *et al*. School nurses' perceptions of concussion management for secondary school student-athletes. *Brain Inj* 2020;34:665–72.
31 Briggs AM, Chan M, Slater H. Models of care for musculoskeletal health: moving towards meaningful implementation and evaluation across conditions and care settings. *Best Pract Res Clin Rheumatol* 2016;30:359–74.
32 Speerin R, Slater H, Li L, *et al*. Moving from evidence to practice: models of care for the prevention and management of musculoskeletal conditions. *Best Pract Res Clin Rheumatol* 2014;28:479–515.
33 Sarmiento K, Donnell Z, Bell E, *et al*. Barriers and opportunities for concussion communication and management in youth sports: a qualitative study. *JADE* 2019;1.
34 Turner RW, Lucas JW, Margolis LH, *et al*. A preliminary study of youth sport concussions: parents' health literacy and knowledge of return-to-play protocol criteria. *Brain Inj* 2017;31:1124–30.
35 Black AM, Yeates KO, Babul S, *et al*. Association between concussion education and concussion knowledge, beliefs and behaviours among youth ice hockey parents and coaches: a cross-sectional study. *BMJ Open* 2020;10:e038166.
36 Liston K, McDowell M, Malcolm D, *et al*. On being 'head strong': the pain zone and concussion in non-elite Rugby Union. *International Review for the Sociology of Sport* 2018;53:668–84.
37 Register-Mihalik JK, Linnan LA, Marshall SW, *et al*. Using theory to understand high school aged athletes' intentions to report sport-related concussion: implications for concussion education initiatives. *Brain Inj* 2013;27:878–86.
38 Milroy JJ, Wyrick DL, Rulison KL, *et al*. Using the integrated behavioral model to determine sport-related concussion reporting intentions among collegiate athletes. *J Adolesc Health* 2020;66:705–12.

BMJ Open Sport Exerc Med: first published as 10.1136/bmjsem-2023-001722 on 16 October 2023. Downloaded from http://bmjopensem.bmj.com/ on October 18, 2023 at Auckland University Technology. Protected by copyright.

Supplement A. Additional information regarding methods

Development of the interview schedule

As part of the broader project, our interdisciplinary research team developed a semi-structured interview schedule exploring actors' perceptions about: (a) concussion knowledge, (b) attitudes towards concussion reporting, (c) roles and responsibilities in concussion management, (d) experience in the CMP, and (e) future considerations and improvements. The schedules were piloted among a convenience sample of school contacts (n=2), physiotherapists (n=3), NZ Rugby representative (n=1) and players (n=10) and revised according to their feedback.

Interview questions and probes were tailored to each specific interview group, resulting in seven separate interview schedules. For the purpose of this study, the analysis focused on a general question pertaining to concussion-related roles and responsibilities:

- With respect to concussions, what do you think your role and responsibilities are?

In addition, all data referring to concussion-related responsibilities identified in other parts of the interview were similarly included. For example, these questions included:

- Can you give me an example of an instance when a concussion may have happened this past season to a player on your team or to a player at one of your games? Can you walk us through what happened? Who was involved? Thinking back, do you think anything should have been done differently?

- Thinking about the whole concussion management process, from education and baseline testing, to a player potentially sustaining a concussion and getting them back to playing, what suggestions would you have to improve the process?

Data collection

Focus groups were conducted at the end of the 2018 rugby season by four interviewers experienced in qualitative methods. The interviewers consisted of MSc and PhD level researchers, 3 females and 1 male. These researchers were employed by New Zealand Rugby (n=3), and by an academic institution as part of a collaboration on the CMP project (n=1). As the interviewers we are all involved in the implementation of CMP to varying degrees, and in

different areas, we arranged each focus group to be facilitated by an interviewer who was not known to the focus group participants. To ensure consistency between interviewers, experienced qualitative researchers conducted training sessions with the interviewers prior to the focus groups. Additionally, interviewers met weekly with the research team to discuss interview consistency, the use of probing questions and paraphrasing to confirm understanding. The focus groups were held at a familiar location (i.e., school or rugby club) and time convenient to the participants and lasted for approximately 30-75 mins. Demographic data were collected using a paper survey.

Analysis

Both researchers involved in the analysis process were experienced in qualitative methods. During the coding and analysis process weekly meetings were held between the two researchers to discuss coding and test assumptions. The broader research team discussed the coding process and provided input on a bi-weekly basis.

Rigor and Trustworthiness

In keeping with the broader project, a study-specific approach to rigor and trustworthiness was adopted.[1,2] In line with our pragmatic approach, it was important to consider how these findings could enhance our understanding of concussion responsibilities within a community rugby system. Developing a practical framework that could aid in this understanding, while being supported by the data, required an iterative process of analysis with numerous reviews by different members of the research team. For this reason, two researchers independently coded and developed a preliminary framework that was then discussed and combined into a composite framework by the research team over the course of several meetings. Supplemental material was included to enhance the transparency of the analysis process. In addition, JC and DMS were actively employed by NZR at the time of study. It was important to consider that these members of the research team have an in-depth understanding, as well as existing perceptions of the context in question, informed by their work within the NZ community rugby system. Although these views aided in contextual understanding, the inclusion of the multidisciplinary research team (from various research affiliations) in the analysis was important to test assumptions, generate discussion, and ultimately develop findings backed by the data collected as part of this study.

Secondly, for the findings to be practically useful, we felt that it was important to maintain and present the detail (the 30 distinct responsibilities), as well as how these responsibilities

contribute to broader themes. As discussed in our limitations section, we were not able to include all potential stakeholders within the community rugby system. Instead, we regard this framework as a foundation for understanding the complexity of concussion responsibilities, from which future research can continue to expand. Within this study and the broader project, we have adopted an approach to saturation as described by Braun and Clarke[12] and Low[13]. These authors suggest that there is always the possibility of new insights and understandings to be gained, for as long as data continues to be collected and analysed. Instead, our focus was on an iterative and rigorous analysis process, of data collected from a variety of diverse stakeholders within the New Zealand community rugby system. Given this was a qualitative study, with a sample size of 155 participants, we believe that our approach to recruitment facilitated a broad and deep understanding of stakeholders within a community rugby system, in which players and parents would make up the largest number of participants, followed by concentrated numbers of stakeholders in supervisory capacities, such as team leads, coaches and finally union NZR representatives.[10]

Supplemental file A References

1 Burke S. Rethinking 'validity' and 'trustworthiness' in qualitative inquiry. How might we judge the quality of qualitative research in sport and exercise sciences? In: Smith B, Sparkes A, eds. *Routledge Handbook of Qualitative Research in Sport and Exercise*. Routledge 2016.

2 Smith B, McGannon K. Developing rigor in qualitative research: problems and opportunities within sport and exercise psychology. *Int Rev Sport Exerc Psychol* 2018;**11**:101–21. doi:10.1080/1750984X.2017.1317357

3 Braun V, Clarke V. To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qual Res Sport Exerc Health* 2019;**00**:1–16. doi:10.1080/2159676X.2019.1704846

4 Bolling C, van Mechelen W, Pasman HR, *et al.* Context Matters: Revisiting the First Step of the 'Sequence of Prevention' of Sports Injuries. *Sports Medicine* 2018;**48**:2227–34. doi:10.1007/s40279-018-0953-x

The quest for clarity in a community rugby system

Supplement B.

Table 1. Responsibilities of community-based rugby stakeholders in NZ

Theme	Content category (numbered): definition	Summative description by category
Policies and support	1. **Develop and implement policy:** To develop or implement policies, protocols or guidelines specific to concussion management 2. **Resource provision and support:** To provide human resources/ trained personnel, or other forms of service or financial support	1. Standardising how players' concussion were managed (e.g., through a unified system, structure or protocol) was perceived as an important component for supporting the optimal management of concussed players from a systemwide perspective. NZR and PU representatives and schools felt it was their responsibility to develop and implement policy. Resource provision and support was both expected and perceived as a responsibility from clubs. NZR and schools were expected to provide resources and support, while provincial union representatives and parents perceived that they were also responsible. 2. Provincial union representatives and clubs described how their ability to provide teams with medically trained staff and support players' welfare (e.g., follow-up post-concussion), was limited by the resources made available to them through the national rugby governing body, Rugby New Zealand. This responsibility was absent at lower levels (4 & 5) but expected of schools and clubs.
Rugby culture, and general management	1. **Support players' welfare and safety:** To promote a safe game culture; oversee, lead or support actions related to general player welfare, health and safety. Taking responsibility for players/ duty of care was a sub-category that formed a large component of this overarching content category. 2. **Buy-in, attitudes and behaviour:** To facilitate change by fostering buy-in for concussion-related initiatives, relationships and work towards developing favourable concussion attitudes and behaviours. Two sub-categories, 'team culture, trust and support' (e.g. fostering trust) and 'compliance' (e.g. adhering to the game rules) formed part of this category.	1. Participants with regulatory, local area governance and supervisory or management positions were responsible for fostering player welfare and safety. For example, NZRU officers noted that they were responsible for promoting a quality experience, which was described as a 'safe game culture'. Provincial Union representatives expected clubs and their coaches promote general player welfare and safety through the support and promotion of education sessions and/or programmes. Sub-category: taking responsibility for players/ duty of care At the team-level of the rugby system, participants expressed the importance of taking responsibility for themselves, as well as others. This was conveyed in terms of sharing the responsibility for players' welfare in the team (e.g. being aware of their own wellbeing 'in the moment' and looking out for teammates), enforcing rules (e.g. blue card) and transferring the duty of care from one actor to another. 2. This theme cut across multiple levels and actors in the rugby system. Participants at the regulatory level, and those responsible for enacting concussion policy/guidelines, felt that their responsibility was to facilitate favourable attitudes from individuals with authority and/or leadership qualities. For example, NZRU officers felt that part of their responsibility

Salmon DM, *et al. BMJ Open Sp Ex Med* 2023; 9:e001722. doi: 10.1136/bmjsem-2023-001722

The quest for clarity in a community rugby system

Theme	Content category (numbered): definition	Summative description by category
	3. **Communication between stakeholders:** To act as a high-level conduit for information sharing and decision-making; facilitation of communication and action of communication between stakeholders to allow optimal concussion management; or to communicate one's medical history (e.g. history of concussion and other injuries) 4. **Injury reporting and administration:** To report serious injuries and utilise information systems within the rugby system to formally record these data. 5. **Education:** To provide or support the delivery of concussion specific education initiatives, including the delivering day-to-day education	was to influence individuals, such as coaches, to take part in educational programmes about concussion. Sub-category: team culture; trust and support In the lower levels of the rugby system, this responsibility was described as influencing team culture. For example, coaches felt that fostering trust (e.g., by listening to concerns, supporting and encouraging dialogue through honesty) influenced concussion attitudes and behaviours (good or bad; e.g. to disclose a suspected concussion, or adhere to concussion protocols). Sub-category: compliance Participants expressed that parents' attitudes and buy-in influenced players' compliance. Players noted that their ability to disclose was influenced by the support of their leadership team, and that implementing change within a team was influenced by the coach, management and the characteristics of players, such as being a star or senior player. 3. Communication was described as a responsibility at every level of the system. Participants referred to communication as: creating networks with other actors in the rugby system; exchanging information about players' injuries with actors, to help support a consistent approach to their management; acting as a conduit to refer actors to sources of information; and the ability of players to communicate openly about their injury history. 4. Participants felt that actors in the rugby system had a responsibility to report players' serious injuries (including concussions) to managers (e.g., PU reps and coaches) for injury surveillance and injury awareness, management and coordination between actors. 5. Education was described at multiple levels of the rugby system. At a national (NZRU) and jurisdictional (Provincial Union) level, supporting and driving the delivery of educational programmes with respect to injury prevention and management (e.g., education about concussion, blue cards, concussion process) was perceived as a key responsibility. At a team level, participants felt there was a responsibility from leaders to reinforce or provide education or seek to empower themselves with knowledge. For example, parents reported the need to educate their children about concussion, but also be knowledgeable about concussion itself.
Individual capabilities	1. **Knowledgeable about concussion:** To be knowledgeable about concussion and concussion	1. This responsibility was a common expectation of actors across the rugby system. For example, participants expect coaches, team leads, players, referees and medics to

The quest for clarity in a community rugby system

Theme	Content category (numbered): definition	Summative description by category
	care (including the self-pursuit of self-education and the rules of the game pertinent to concussion (e.g., stand down period) 2. **Knowledgeable about first-aid:** To be knowledgeable and/or have the capability to act as a first responder in an accident 3. **Authority and leadership**: To demonstrate authority and leadership through decision-making, supervision and influence 4. **Enforcing protocols:** To monitor and enforce concussion protocols and consistency in management between stakeholders 5. **Role multiplicity and task shifting:** To take more responsibility and make more decisions if the actor primarily responsible for duty is unavailable	knowledgeable about concussion. Parents, however, considered this to be important self-identified responsibility. 2. Coaches and team leads were expected to be first aid trained; however, it was not a responsibility that they perceived themselves. Referees were also expected to be knowledgeable about first-aid. 3. Making authoritative management and/or clinical decisions, such as stopping the game, deciding whether a player should play or not, or delegating responsibilities of other actors in the system (e.g., spotting for injuries). At the managerial level of the system, participants felt that coaches, physiotherapists and general practitioners had authority and leadership responsibilities. There was less overlap at the lowest level of the rugby system, with referees expected to, and team leaders self-identifying in this responsibility. 4. Participants considered that New Zealand Rugby, provincial union representatives, clubs and coaches had a responsibility to enforce protocols or rules for managing concussion. While participants expected PU reps and coaches to enforce protocols, this responsibility was both expected from the participants and perceived as responsibility by clubs. It was not a self-perceived responsibility by actors in the lowest level of the system parents or healthcare providers (GP, physiotherapists and school nurses), though it was an expected responsibility by other actors. 5. Team leads and medics/undergrad physiotherapists identified a need to assume the physiotherapist's and coach's responsibility, when required. Some stakeholders expressed discomfort and anxiety related to task-shifting and accepting responsibility usually aligned with other responsibilities.
Intervention following a suspected concussion (in the context of the New Zealand Rugby Concussion	1. **Disclose:** To tell someone about a suspected concussion, whether personally experienced or externally observed 2. **Spot and recognise (awareness):** To be aware/ alert to concussions, in self and others	1. Disclosing a concussion was both perceived by, and expected only of players. 2. Coaches, parents and team leads (including medics and physiotherapists) were both expected to and perceived this as a responsibility. Schools and referees were also expected to undertake this responsibility. 3. This was a self-identified responsibility of physiotherapists and medics. It was not expected nor perceived as a responsibility of other actors in the system. However, team

The quest for clarity in a community rugby system

Theme	Content category (numbered): definition	Summative description by category
Management Pathway)	3. **Log Concussion:** To be responsible for logging concussions specifically via the CMP phone-based application 4. **Remove:** To remove self or others from field following a suspected concussion 5. **Stop game:** To stop the game following a suspected concussion 6. **Use blue card:** Referee issuing a blue card during game play as part of the game rules 7. **Acute medical management:** To provide on-field medical support following a suspected concussion, including assessment of injuries, deciding if return to play is appropriate and diagnosing injuries 8. **Leadership and logistical management/coordination as part of acute incident**: Where an actor undertakes a leadership responsibility specifically in the acute phase of an injury. For example, delegating an actor's responsibility, using authority to override other's decisions about return to play and undertaking the immediate coordination of care for the injured player 9. **Acute on-field support:** To provide support on the field following a concussion incident, which includes supporting the coach and/or assisting with transferring duty of care (e.g., following up with the injured player on the side-line)	leads did allude to feeling pressure to log concussions, which overlapped with the 'responsibility discomfort' and 'task shifting' categories. 4. Coaches, parents, team leads and players all identified this as their responsibility; this responsibility also was expected of referees. 5. Parents and players expected coaches to stop games, however coaches did not perceive this as their responsibility. Players self-identified in this responsibility, for example if a suspected concussion was not identified by side-line spotters. Referees were also expected to stop the game. 6. Referee issuing a blue card during game play to trigger the immediate removal of a player, mandatory stand-down period, and the reporting of the suspected concussion to the provincial union. Referees and team leads were expected to use the blue card; however, the latter actor was expected to intervene before a blue card could be issued to avoid triggering the mandatory stand down period (rather than use it) 7. Coaches did not identify with this responsibility; however it was expected by other actors in the rugby system. This was a perceived and expected responsibility from team leads (through physios and medics) and expected from referees. 8. Coaches and team leads (through physiotherapists and medics) were both expected to, and self-identified in this responsibility. Parents, in particular, were the only actors who expected this responsibility from coaches. There were no expectations from other actors in the system to undertake this responsibility except from referees. 9. Acute on-field support was self-identified and expected of parents. Team leads and coaches were the only other two actors which identified it as one their responsibilities; it was not expected of any other actors in the rugby system 10. The general practitioner was the only actor in the rugby system which was expected to provide a medical diagnosis for concussion. 11. Coaches, parents and team leads felt responsible for directing players to medical support following a suspected concussion; however, the same was not true of other actors in the system. Similarly, players felt that it was their responsibility to seek diagnosis and treatment following a concussion, too.

The quest for clarity in a community rugby system

Theme	Content category (numbered): definition	Summative description by category
	10. **Diagnose:** Providing a medical assessment of the player for a diagnosis of concussion 11. **Seek diagnosis and treatment:** Advising players to seek medical help specifically following a suspected concussion 12. **Follow recovery protocol:** Specifically following aspects of the gradual return to play and graduated return to learn protocols; to guide players through, or be an active participant (to action) in the GRTP and GRTL, treatment and individual rehabilitation 13. **Manage recovery process:** Manage, oversee and coordinate the recovery and clearance process, ensuring the recovery protocol is followed, including training and medical clearance 14. **Follow-up:** The general actions of follow-up on player's diagnosis status, recovery and subsequent management, including players' progression through the CMP 15. **Clearance:** To seek or provide medical clearance as a prerequisite for players to return to play 16. **Quality of care:** To deliver healthcare that is multidisciplinary and consistent in objective and optimal management 17. **Responsible for Baseline testing (BLT):** To conduct, champion and/or utilise baseline	12. The responsibility was perceived by coaches and players, and physiotherapists were expected to provide this responsibility (it was not perceived nor expected from team leads). 13. Schools and clubs were expected to undertake this responsibility but they did not identify themselves in it. Coaches perceived that this was one of their responsibilities, but other actors did not expect it from them. Team leads were the only actors that were expected (including physiotherapists and GPs) and perceived by other actors to drive this responsibility. 14. Team leads were the only actors in the system which both self-identified and were expected to undertake this responsibility. Provincial union representatives and coaches perceived this as one of their responsibilities (but not clubs), while schools, physios and GPs were expected to fulfil this responsibility. Provincial union representatives, in particular, expressed uncertainty with the scope/ end-point of follow-up (e.g., who's responsibility is it at home) 15. Provincial union representatives perceived that it was their responsibility to ensure that players had received medical clearance prior to return to play. Actors expected GPs to provide medical clearance, and physiotherapists to check that players had sought medical clearance before returning to play. Coaches, parents, schools and clubs were not associated with this responsibility. 16. Participants expected general practitioners to be knowledgeable about concussion, deliver evidence-based care (e.g., follow rugby protocols and baseline assessment), provide medical clearance, education, follow up and facilitate communication between actors. This responsibility was not identified in any other actor in the rugby system. 17. Physiotherapists and team leads perceived that one of their responsibilities was to support/facilitate baseline assessment of players. This responsibility was also expected of coaches, however it was not a self-identified responsibility. 18. Coaches and team leads expected general practitioners to utilise the CMP portal to inform their clinical decision-making when assessing players.

The quest for clarity in a community rugby system

Theme	Content category (numbered): definition	Summative description by category
	concussion assessment either before, or after a suspected concussion has occurred 18. **Use portal:** To use a bespoke online website, which grants general practitioners access to players' baseline assessment, as part of the New Zealand Rugby CMP	

Table 2. Potential pressure points identified in the NZ rugby system

Theme location	Potential Pressure points identified in findings	
Policies and support	Support for implementation and continuation of initiatives	• The governing body places importance on education and player welfare, however stakeholders appeared to expect more tangible support / presence at grass roots (for example, human resource support, support for smaller schools and female rugby)
Rugby culture and general management	Ensuring communication flow	• NZR was expected by team leads and players to be more involved with communicating new research evidence; however, it was not a responsibility they identified in themselves. Some parents also perceived NZR to be more interested in communicating game promotion (e.g. making sure the field 'looked good') rather than players' welfare per se. PU representatives perceived that it was their responsibility to communicate with schools, parents and healthcare providers about a players recovery status; yet other actors in the rugby system did not expect this from PU representatives. Instead, coaches and team leads were expected to facilitate communication flow. This may explain the discomfort PU representatives expressed about where their duty of care ended once a player returned to their normal daily activities and their need to engage in role multiplicity and task shifting. Parents also perceived that they were responsible for facilitating communication between actors, yet other actors in the rugby system did not expect this from parents. Clearly defined stakeholder responsibilities may facilitate the flow of communication.
	Clarity on responsibilities pertaining to injury reporting	• Injury reporting and administration is inconsistently considered across the rugby system. It was considered a 'shared' responsibility of PU representatives, coaches and the wider team. Yet while

The quest for clarity in a community rugby system

		schools, clubs, team leads and parents were expected to undertake this responsibility by other actors in the NZ rugby system, it was not perceived or self-identified. • These findings suggest that injury reporting and administration is may not be optimally monitored in schools, and that PU representatives rely on coaches to report injuries without support from their club. This highlights that there may be an injury surveillance gap within the school setting.
	Clarity on education responsibility, and facilitation of positive concussion culture for all relevant stakeholders – move towards continuous, multi-level and multi-medium (formal and informal) education initiatives and building of a positive concussion culture	• Education about concussion was a responsibility that was commonly perceived or shared by actors in the NZ rugby system. However, in schools, it was not expected nor perceived as a responsibility and, in clubs, it was expected but not perceived. • Buy-in, attitudes and behaviours concerned with facilitating change (e.g. game culture) was prominent at higher levels of the rugby system while at the lower levels it was more related to the actions of actors in a team that support trust and compliance (e.g. with the game rules). Schools and clubs did not perceive this as one of their responsibilities. • Our interpretation is that there may be underleveraged assets within schools and clubs to better shape concussion culture in the rugby system.
Individual capabilities	Clarity on leadership and authority responsibilities, with emphasis on the delegation of responsibilities according to available stakeholders. Support and task -shifting opportunities for stakeholders with multiple responsibilities and 'responsibility overload'	• Authority and leadership' were a 'shared' expectation of coaches. It was expected from schools, clubs and team leads (including physiotherapists, GPs, referees and medics) who did not perceive this responsibility. There was cross-over with 'role multiplicity and task shifting' among the actors of coach and team lead; however, this responsibility was also present among schools and PU reps. • The school representative also noted some discomfort with the amount of responsibility associated with his responsibility, while the extent of expected responsibilities of the school was substantial.
	Being knowledgeable about concussion perhaps perceived as a 'given' but should be key priority of all stakeholders	• Players and parents perceived being knowledgeable about concussion as their responsibility, but coaches and team leads did not identify this as their responsibility.
	Clarity on responsibilities between PU representatives and schools/clubs, especially with regards to follow-up Building trusting relationships in relevant stakeholders regarding duty of care and establishing clear responsibility demarcation	• PU representatives take on a lot of responsibility, the uncertainty with regards to where duty of care stops, creating potential overlap or gaps with the responsibility of the school or the club

The quest for clarity in a community rugby system

Intervention following a suspected concussion (in the context of the New Zealand Rugby Concussion Management Pathway)	Clarity on responsibilities for recognising / spotting / removing If it is everyone's responsibility, who takes ultimate responsibility to ensure it is done (who is actually doing it, and at which time-points?) Support for players to stop the game	• Substantial overlap was evident in 'spotting and recognising' a concussion. A shared responsibility for coaches, team leads and players was to remove players from play following a suspected concussion. Parents perceived this as their responsibility, but other actors did not expect them to fulfil this responsibility, perhaps reflecting the power dynamic between parents and coaches. To stop the game was expected from coaches who did not perceive this as their responsibility. Players perceived this as their responsibility in the absence of other actors stopping the game. Notwithstanding referees, who were not interviewed, this suggests that players are the only actors in the system who believe it is their responsibility to stop the game following a suspected concussion.
	Player attitudes and beliefs around disclosure and avoiding be 'blue carded'	• Some players reported that it is up to the player to decide on the field whether what they are experiencing is serious enough to disclose. • Looking out for each other was favourable responsibility identified in players and wider team. However, players also understood this as 'having each other's backs' to avoid being blue carded.
	Clarity on responsibilities for coaches, team leads and healthcare professionals during acute concussion incident First aid training for coaches for instances when no medics or team leads available	• 'Leadership and logistical management/ coordination as part of acute incident' was a 'shared' expectation of coaches and team leads also perceived that this was part of their responsibility (and expected of physiotherapists, medics and referees). Acute medical management' was self-identified in team leads (and as an expectation of physiotherapists, medics and referees). It was also expected of coaches, who did not perceive this as a responsibility.
	Clarity on responsibilities regarding follow-up to enhance efficiency If it is everyone's responsibility, who takes ultimate responsibility to ensure it is done (who is actually doing it, and at which time-points?)	• Extensive overlap was evident in the 'follow up' responsibility, which was identified as a shared responsibility among PU representatives, coaches, physiotherapists and team leads. It was also expected of schools. Physiotherapists were expected to follow up with GPs about the medical clearance of players.
	Clarity on the school and club's responsibility in managing recovery Enhancing parents' responsibility (including knowledge and awareness) in recovery process	• Coaches and team leads were expected to manage recovery process with the latter also perceiving this as their responsibility. Interestingly, schools and clubs were also expected to manage this responsibility, while parents did not perceive nor were they expected to undertake this responsibility.