



Original research

Unintended consequences - A qualitative exploration of baseline testing in community rugby concussion management

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ABSTRACT

Objectives: Understanding key stakeholders' perceptions around the value of baseline testing, as well as barriers or facilitators experienced as part of the process, may assist with the decision-making process of whether to implement baseline testing in community sport. This study explored coaches', players' and physiotherapists' perceptions of the perceived value, barriers and facilitators of baseline testing as part of New Zealand Rugby's (NZR) community concussion initiative.

Design: The study employed a pragmatic, qualitative descriptive design.

Methods: Semi-structured interviews were used to explore participants' perceptions. In total, 73 individual interviews were conducted. The sample consisted of 36 players, 13 coaches and 24 physiotherapists involved in NZR's concussion management pathway. Interviews were audio-recorded and transcribed verbatim. Data were analysed using thematic analysis.

Results: In terms of perceived value, baseline testing was reported to play a role in i) facilitating a positive concussion culture; ii) positive perceptions of rugby and player safety and iii) enhancing concussion management as part of the pathway. Barriers and facilitators of the baseline testing process included i) stakeholder buy-in as critical driver of the process and ii) contextual and operational factors. Although contextual and operational challenges exist, these participants, as key stakeholders in the process, perceived the value of baseline testing to be more important than the barriers experienced.

Conclusions: The value of baseline testing extends beyond concussion assessment and management, by enhancing community concussion awareness, attitudes and player safety. The findings of this study may assist in the decision-making process around inclusion of pre-season baseline testing in community rugby.

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Practical implications

- This study found that the value of baseline testing may extend beyond its role in concussion assessment. Baseline testing may add value by creating awareness, enhancing a safe and positive concussion culture within the team, and by contributing to overall player safety, by engaging them early in the concussion management process which may enhance overall compliance to the pathway.
- Resource constraints and logistical challenges pose barriers to the implementation of baseline testing in community level rugby.
- Participants in the current study indicated that the value of conducting baseline testing outweighed the challenges experienced when using an assessment tool specifically developed for community

rugby. These findings can assist in the decision-making process around the inclusion of baseline testing in community-level rugby.

1. Introduction

Sports-related concussions (SRCs) are a cause of global concern, with growing awareness of the high incidence and resulting adverse short- and long-term effects. Rugby union (henceforth rugby) is one of the sports with the highest incidence of SRC.¹ The incidence rate of concussions in elite rugby has been reported as 14 concussions per 1000 player-match-hours in male rugby and 10 concussions per 1000 player-match-hours in women's rugby.² For community level players (school and senior level), concussion incidence rates of 3–4 concussions per 1000 player-match-hours (male), and 6–8 concussions per 1000 player-match-hours (female) have been reported.² However, the true incidence of concussions in rugby is estimated to be greater due to what is believed to be a high level of under reporting.^{3,4}

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Rugby is a popular sport in New Zealand (NZ), with 159,773 amateur players registered during the 2019 season according to the NZ Rugby (NZR) database. Concussions sustained through participating in rugby, account for 3.1% of all injury claims made to the Accident Compensation Corporation (ACC), NZ's national injury insurance provider.⁵ SRC places a significant burden on the individual, their team and wider healthcare system due to the associated healthcare costs, negative impact on an individual's health, recovery time away from play, and potentially prolonged symptoms.⁶ In addition, concussion management guidelines have been inconsistently implemented in community level sport.^{7,8} The implementation of guidelines is hindered by coaching or management staff often having inadequate concussion knowledge or unfavourable attitudes towards concussions, communication breakdowns amongst stakeholders, or lack of clarity of concussion responsibilities within the community rugby system.^{7–9} The challenges for rugby governing bodies are enforcing and creating awareness of these guidelines at the community level of the game, and within the health profession.¹⁰ At elite level, rugby teams have access to a physiotherapist or a medic, but this would not be the norm for the majority of community teams.

With these concerns in mind, NZR developed a concussion management pathway (CMP) to improve the management of these injuries in the community setting.¹¹ The CMP begins with pre-season concussion baseline testing utilising the NZR Concussion Assessment Tool (NZRCAT), to assess players' baseline symptomatology, neurological and cognitive status.¹² The NZRCAT is a modified version of the Sport Concussion Assessment Tool family of assessments¹³ that has been adapted for the community setting.^{12,14} The development of the NZRCAT was informed by a collaborative initiative between New Zealand Rugby and general practitioners in NZ.¹⁴ General practitioners reported seeing a limited number of concussions, having limited experience with best practice and return-to-play guidelines and the standardised assessment tools like the SCAT5, and insufficient time to perform a clinical examination and patient education.^{12,14} These challenges experienced by general practitioners have also been documented internationally.¹⁵

At the time, the 5th International Consensus Statement on Concussion in Sport recommended the use of the SCAT5 as evaluation tool. A major barrier to the utilisation of the SCAT5 was the base knowledge on how to use it and the time required to complete the assessment, as appointments with a general practitioner in NZ are limited to 15 min.^{14,15} In addition, general practitioners found the balance error scoring system (BESS) to assess dynamic balance, complicated to implement and score.¹⁴ The development of the NZRCAT also considered the influence of the community context on baseline testing. For example, time pressures administering the SCAT5 and literacy challenges arose regarding the descriptors in the symptom checklist of the SCAT5. As a result, the NZRCAT was developed in collaboration with general practitioners in the community to assist with these challenges.¹² The NZRCAT includes the child SCAT5 symptom list¹⁶; the Standardised Assessment of Concussion 50 (SAC 50) as contained in SCAT5¹³; and a dynamic coordination assessment consisting of the Tandem Gait protocol as contained in the SCAT3.¹⁷

During the pre-season, the NZRCAT is administered via a mobile phone application (App) usually by a physiotherapist or sports medic and takes approximately 5 min to complete. During the season, if a player incurs a suspected concussion, the suspected concussion is logged on the App by the team manager or physiotherapist. The App generates email notifications that are sent to key stakeholders, including parents, players, coaches and the local rugby governing body (provincial union), informing them that a suspected concussion has occurred. The email strongly recommends that the player attends a medical diagnosis visit and informs stakeholders that clearance will be required from a general practitioner (medical doctor) before they are allowed to return to play. Once the player attends a diagnosis visit the general practitioner repeats the NZRCAT, and compares these scores

to the baseline scores using an online portal. A visual representation of this pathway is provided in Fig. 1. The baseline test thus provides individual scores to assist the general practitioner with the clinical diagnosis of a concussion, and clearance for return-to-play.

The main purpose of a baseline test is to assist a clinician's clinical assessment of concussion by providing objective scores on symptoms, neurocognitive function and dynamic balance.¹³ Following a concussion, post-injury scores are compared to baseline scores to assess whether deficits have occurred. Other neurocognitive assessments such as the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) test can also be used at baseline. However, multiple questions have been raised around the collective reliability and validity of baseline testing, including the components included in the NZRCAT, and its advantage over using normative values.^{6,18,19} In this respect, decisions around the use of baseline testing are primarily informed by the reliability and validity of the test and its clinical utility, whilst its role in other aspects of the concussion management process has yet to be explored.

Recent research reported that baseline testing may indeed have other benefits, such as enhancing players' concussion safety decisions.²⁰ Although tested within hypothetical situations, these findings are thought-provoking. The mechanism for these effects may be explained by the interactive and individualised nature of baseline assessments, in which baseline testing might be considered as a form of concussion education.²⁰ This type of interactive learning may be more memorable in terms of demonstrating the functional consequences of sustaining a concussion, resulting in more favourable perceptions of concussion safety behaviour.²⁰ World Rugby requires mandatory completion of annual baseline concussion assessments for any competition where the Head Injury Assessment protocol is in place, primarily for tier 1 professional leagues. Current recommendations suggest that baseline testing may be useful when sufficient resources are available but do not support compulsory inclusion of baseline testing at non-elite levels of sport.^{6,21} Considering the time, personnel resource and cost requirement, as well as the absence of supporting evidence, there is debate as to whether baseline testing is valuable or necessary.^{12,22}

Therefore, stakeholders' perceptions around the value of baseline testing, as well as barriers or facilitators experienced as part of the process, may assist with the decision-making process of whether to implement baseline testing in community sport. Understanding end-users' (for e.g., sports participants, coaches, healthcare providers and administrators) subjective perceptions of the benefit or value of a programme, the extent to which they believe the programme is better than current practices, and how easy or difficult the programme is to use, acts as key determinants to eventual programme adoption.^{23,24} In the NZ rugby context, coaches, players and physiotherapists are the stakeholders most closely involved in the baseline testing process. Thus, the aim of this study was to explore; coaches', players' and physiotherapists' perceptions of the perceived value, barriers and facilitators of baseline testing as part of NZR community concussion initiative.

2. Methods

In line with the broader CMP study, this study adopted a pragmatic, descriptive, qualitative approach.²⁵ Pragmatic research is underpinned by finding the most practical and sensible way to answer a research question, and to provide descriptive information that can inform professional practices or policy.²⁵ Approval to conduct the study was granted by University of Otago Human Research Ethics Committee (18/087). Reporting followed the Consolidated Criteria for Reporting in Qualitative Research (COREQ) guidelines. Additional detail regarding the methods can be found in Appendix 2.

As part of a broader project, we investigated multiple relevant stakeholders' perceptions of the CMP and its various components, at the end of the 2019 rugby season. Within this broader project, semi-structured interviews were conducted in three geographically and socioeconomically diverse provincial rugby unions (regions). Within the participating

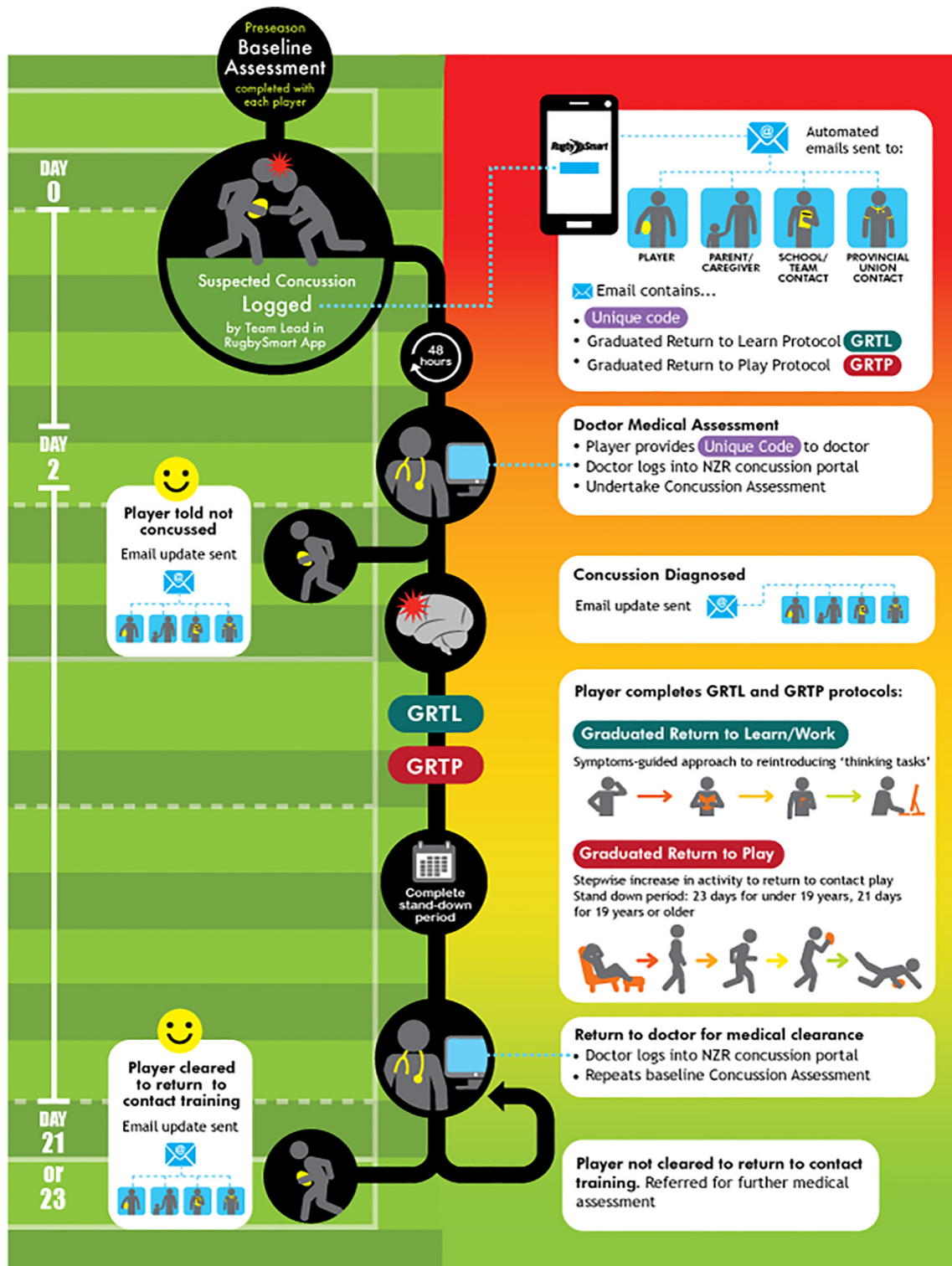


Fig. 1. New Zealand Rugby's concussion management pathway.¹¹

provincial unions, high school rugby administrators and premier-level community clubs were contacted to identify high school and club teams who would be interested in participating in the study. These school and club teams then identified team leads (person in charge of logging concussions on the App), as well as coaches, players and parents who were involved in the CMP, and these individuals were then invited to participate. Physiotherapists and general practitioners involved with the CMP were also invited to participate. All physiotherapists and general practitioners involved in CMP had been exposed to the

administration of the NZRCAT. Physiotherapists were involved in the administration of the baseline assessment and general practitioners repeated these assessments as part of the diagnosis and clearance assessment.

Participants were informed of the study goals and consent was obtained from those who wished to participate. The interviews were held at a familiar location (i.e., school or rugby club) at a time convenient to the participants; were audio-recorded; and lasted for 30–75 min (full interview covering all phases of the CMP).

Table 1
The demographic details of the coaches, physiotherapist and players involved in the interviews.

Variable		Coaches	Physiotherapists	Players	Total
Gender (n)	Males	11	13	35	59
	Females	2	11	1	14
Age (years)	Mean (SD)	44.5 (7.5)	28.1 (7.7)	19.8 (4.8)	26.9 (10.9)
	Range	28–55	22–52	14–32	14–55
Region (n)	Hawke's Bay	4	10	12	26
	North Harbour	2	5	10	17
	Otago	7	9	14	30
Ethnicity n (%)	NZ European	8 (61.5)	19 (79.2)	24 (66.7)	51 (69.9)
	Māori	3 (23.1)	3 (12.5)	1 (2.8)	7 (9.6)
	Pasifika	1 (7.7)	0 (0)	4 (11.1)	5 (6.9)
	Other	1 (7.7)	2 (8.3)	7 (19.4)	10 (13.7)

N, number; SD, standard deviation.

For the purpose of the study reported here, interview data relating specifically to participants' perceptions of baseline testing was extracted from the broader project investigating the CMP. This analysis focused on stakeholders that are most directly involved in the process of pre-season baseline testing in the sample, namely coaches, physiotherapists and players. A detailed description of the components of the NZRCAT is outlined in Appendix 1. As general practitioners' utilisation of baseline testing was more oriented towards diagnosis and management once a suspected concussion has occurred, their results are reported elsewhere.¹⁰

From the 123 stakeholders interviewed in the broader project, individual interview data from 36 players who had sustained a concussion during the 2019 season, 13 coaches and 24 physiotherapists were included in the current study (n = 73 individual semi-structured interviews) (Table 1).

Audio recordings were professionally transcribed, verified and organised in NVivo 1.4 (QSR International). Inductive thematic analysis was used to analyse the data.²⁶ Initial familiarisation and coding were completed separately for each stakeholder by two authors and discussed weekly with the research team for the duration of the analysis. Codes across all stakeholder groups were sorted and collated into themes and sub-themes. An iterative process was used within the research team to develop both initial and final themes. Regular team meetings were held during the analysis phase to test assumptions and evaluate coherence in interpretation. Regarding saturation, we believe that there is always potential for new insights as long as data continues to be collected.²⁷ Instead, our focus was on gaining context-sensitive insights from participants that we considered to be critical role players and key informants, as well as on a rigorous, iterative analysis process.

The interview team was involved in the implementation of the CMP and was thus known to the participants. It was our experience that the existing rapport and mutual understanding between the interviewers and the participants contributed to the depth of data. Nonetheless, it is possible that these prior relationships may have affected what participants felt comfortable to share regarding their experience. For this reason, every effort was made to create a comfortable environment that encouraged unrestricted sharing of experiences.

3. Results

Fives themes were developed from the data. Themes and sub-themes are grouped according to stakeholders' perceptions of (a) perceived value of baseline testing and (b) the barriers and facilitators of the baseline testing process (Fig. 2).

3.1. The value of baseline testing

Three themes related to stakeholders' perceptions of the value of baseline testing: 1) facilitating a positive concussion culture; 2) baseline

testing's role in positive perceptions of rugby and player safety and; 3) baseline testing's role in concussion management as part of the CMP.

3.1.1. Theme 1. Facilitating a positive concussion culture

Identified as a major theme within the data, the majority of participants across stakeholder groups felt that baseline testing contributed to a positive culture around concussion, as it enhanced concussion knowledge and awareness, and helped to form favourable concussion attitudes.

3.1.1.1. Sub-theme: Baseline testing enhances concussion knowledge and awareness.

Participants felt that baseline testing provided an interactive concussion education opportunity for the team, which contributed to players' concussion knowledge and awareness. It provided players, as well as the wider team, insight into various symptoms and potential functional deficits that may arise when concussed:

I think it was a really good way for the boys to have a little bit more understanding about the process. I think just everyone being more aware of concussions in general, and the signs and symptoms... and that's all of management, coaching, everyone. It was good that was more sort of the forefront of everyone's minds, more than what it had been.

[(Physiotherapist)]

Several participants reported the value of having completed a baseline test in helping players realise when they have a concussion, or in helping them, and their coaches, gauge their recovery.

I think it provides a level of education for the players [...] and that's like a clear process you have to go through and it's clear if they haven't passed because you can look back on their results whereas in the past they'd probably go, "Oh I feel better now." Or like, "I'm not getting headaches, so I'm recovered." But it's something they have to go through, and they can understand.

[[Coach]]

3.1.1.2. Sub-theme: Baseline testing drives favourable concussion attitudes.

Participants reported that starting the season with baseline testing, facilitated a positive shift in attitudes towards concussion management within the team as it placed concussion at the forefront of everyone's minds, and impressed the importance and seriousness of a concussion injury:

Yeah, I just think most of the boys knew about it as well and then they remembered people coming in to do baseline. I think it educated them more around, well that obviously puts more of an emphasis on it. So, they were definitely more motivated than what they would've been in the past to seek help, because they know that it's so standardised and it's also seen as the system they have to follow.

[(Physiotherapist)]

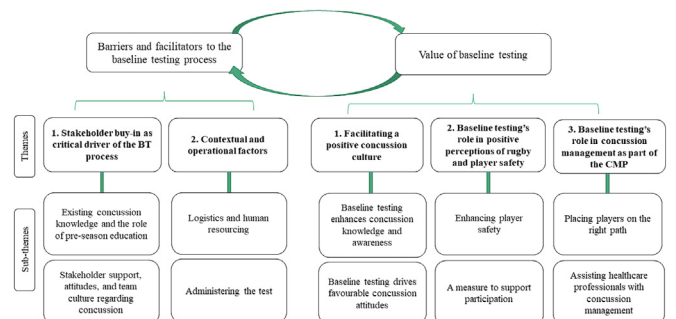


Fig. 2. Stakeholders' perceptions of (a) barriers and facilitators to baseline testing process and (b) the value of baseline testing.

Participants felt that this helped improve buy-in, concussion reporting, and overall support for the CMP. Having completed a baseline test and then experiencing how difficult the same test could be after sustaining a concussion, convinced players of the seriousness of concussion:

The boys learned. That's something they started to realise that it was serious themselves. Going through it and I think it was one of the boys went "yeah yeah" about it, until that first concussion when [a player] did the test, and the boy failed, and they went "Gee he's quite bright" ...and it was suddenly like "No, this is to be taken seriously". The players started to realise, and I think they started to feel that they were being cared about.

[[Coach]]

3.1.2. Theme 2. Baseline testing's role in positive perceptions of rugby and player safety

Baseline testing was perceived by several stakeholders to play a valuable role in creating favourable perceptions around the importance that is placed on player welfare and safety in rugby.

3.1.2.1. Sub-theme: Enhancing player safety. After being actively involved with baseline testing, most participants across all three stakeholder groups believed that baseline testing was valuable to enhance player safety:

When I was doing it [baseline testing], I was like, oh yeah, this is actually pretty good because head knocks are really bad. Some people like going, well I just can't be bothered leaving and that kind of thing. And then you kind of just go, well actually it's really important because your head, you've only got one of them.

[[Player]]

In addition, participants (especially players and coaches) noted that it should be implemented across the wider rugby community and integrated into other sports. It also provided data of each player's cognitive ability to compare against if a concussion occurred, which participants believed helped to mitigate the challenge of dealing with players who try to disregard or circumvent the process (i.e., difficult to hide a concussion if the scores show you are not functioning the same as before your concussion).

3.1.2.2. Sub-theme: A measure to support participation. According to participants, in particular players and coaches, baseline testing helped to reassure players and their families that players' welfare was being taken seriously whilst playing rugby:

You know we're school boys, we're the next generation, I guess, so it's good that you guys are looking out for us now and stuff like that.

[[Player]]

It was interesting how at the start of it [when completing the first baseline], it was fine, but then on Monday I just couldn't really... They were just shocked at how bad I was. But no, I was actually really, really impressed and my parents also, I was telling them about it, they said they're real impressed with the process.

[[Player]]

Participants felt that baseline testing showed the community that safety precautions were implemented, which should support decisions around participation:

Because at the end of the day, we want everybody to carry on after rugby, and coach, and have their kids play. We're talking about young men. Have their families, have their careers, bring their young kids back to rugby because they'll get looked after if they have a knock.

[[Coach]]

What measures are you doing to keep my kid safe? And that's where I think this program has potential to highlight... you know actually we acknowledge that they happen, but we're doing a lot to... nobody's going to, nobody care... doesn't know about the tackle technique as people would say, but they know that they're baseline-tested, and doctors are involved...

[[Coach]]

3.1.3. Theme 3. Baseline testing role in concussion management as part of the CMP

Several participants across stakeholder groups felt that baseline testing played a valuable role in concussion management as part of the CMP, as it facilitated placing players on the correct management path, and assisted healthcare professionals in managing the concussions.

3.1.3.1. Sub-theme: Placing players on the right path. Participants felt that completing the baseline test was important, as it was the first step of the CMP. The CMP allowed for a quick referral path for concussion assessment and management and created a process to fall back on to enforce player safety:

If you do have a baseline and go through the necessary procedures, you're going to be back on the field in the shortest safest time possible. Instead of having to follow a longer stand down or a longer duration just because you didn't take the 10 min at the beginning of the season.

[[Player]]

By completing a baseline test, and logging a subsequent concussion in the App, it contributed to a streamlined concussion management process. Being able to compare scores after a concussion to pre-season baseline test scores facilitated concussion management.

3.1.3.2. Sub-theme: Assisting healthcare professionals with concussion management. Participants believed that a key value of baseline testing was its ability to assist clinicians in recognising, diagnosing, managing, and determining medical clearance for concussion:

I was pretty sure that I was concussed, but I wasn't certain, and so we did the same couple of tests, I think. And he found the baseline that I had online and realised pretty quickly that, yeah...he was like, "Yeah, you're definitely concussed yeah..." Definitely a good thing that the doctor had that.

[[Player]]

Physiotherapists felt that baseline scores provided an individualised outcome measure of the players' cognitive ability that general practitioners could use as part of establishing a diagnosis:

We had something to compare the players against, because say if they were to get a concussion two weeks in, and you've only been working with the team for say two weeks pre-season, we don't know the players yet. So being able to have something to compare against means that you had something to fall back on. So by the end of the season, I could recognise one. Getting the baseline testing and knowing that that was there, it made me more comfortable knowing that if they were going to a GP (general practitioner), it wasn't a, "Oh yeah, played rugby, had a head knock, you've got a concussion." There was actually some basis behind their diagnosis...

[[Physiotherapist]]

Some physiotherapists and players suggested that its value would improve further if baseline testing scores were considered in decision-

making to reduce stand-down periods following concussion injury. Established relationships between physiotherapists and general practitioners facilitated communication which was important for the efficient use of baseline testing data. However, some physiotherapists and players noted that there was no point in conducting a baseline testing if general practitioners did not use the baseline testing scores during their consultations:

He [referring to the general practitioner] didn't really do a baseline test or nothing along the lines of that. He was just saying things about the concussion. He was kind of giving information, not really testing.... Yeah, and he just said, "You might have a concussion," I was kind of hoping for the baseline test or something just to see if I was concussed

[(Player)]

3.2. Barriers and facilitators of the baseline testing process

Two themes describe stakeholders' perceptions of barriers and facilitators to the baseline testing process 1) stakeholder buy-in; and 2) contextual and operational factors.

3.2.1. Theme 1. Stakeholder buy-in as critical driver of the baseline testing process

Stakeholder buy-in described the willingness and dedication of stakeholders to drive, or take part in the process of baseline testing. These attitudes played an important role in the successful completion of baseline testing. Buy-in appeared to be facilitated by stakeholders' existing concussion knowledge, and the support and the general attitudes around the seriousness of concussion amongst these key stakeholders.

3.2.1.1. Sub-theme: Existing concussion knowledge and the role of pre-season education. All three stakeholder groups described existing knowledge of concussions and understanding of the significance of the injury as key facilitators towards buy-in for conducting baseline testing.

Well, it's such a serious thing. Concussions are so serious. And player welfare. I mean...if you're not thinking about a person's wellbeing then you've got issues [referring to the importance of implementing strategies that could enhance player welfare, such as baseline testing]. Especially a young person...and I'm very conscious of people's wellbeing before all else..

[(Coach)]

Participants believed that knowledge was particularly enhanced by pre-season education sessions and discussions around concussion:

It was just good to have a kind of a big chat at the very start of the season to say, okay, concussion is quite important. Involving in the players, coaches and whatnot all together rather than just the physio comes, okay, let's do concussion stuff. By having a whole initiative to kind of drill it in the players.

[(Physiotherapist)]

Participants suggested that players, parents, coaches, and managers all benefited from these sessions and that it supported and strengthened the reasons for conducting baseline testing.

3.2.1.2. Sub-theme: Stakeholder support, attitudes, and team culture regarding concussion. Physiotherapists and coaches identified support from the school, club or provincial unions for physiotherapists to implement baseline testing and relaying the value of baseline testing to the team, as an important facilitator to the process. Having leaders and role models within the team (for example, physiotherapists, coaches

and senior players) to promote baseline testing was perceived as essential to its success:

The people that are essential are the physios and their no-nonsense attitude towards it [baseline testing] and our management and coaching staff. We're the guys that have got to push it. We're the guys that have got to notice.

[(Coach)]

All three stakeholder groups reported that an individual's general attitude towards a concussion, and a "good club culture" were important determining factors for the success of baseline testing. The majority of players took baseline testing seriously, which acted as a facilitator to the process. Participants reported that poor attitude, lack of buy-in or understanding of concussion could undermine the success of baseline testing.

Yeah, yeah, everyone took it seriously. So, one of the old boys who doesn't play anymore, but he was making jokes about, "Just go in and get a terrible score, so that when you're actually concussed, you can carry on playing." And I thought, "That's not really the attitude you want."

[(Player)]

Some coaches and physiotherapists felt that by making it clear that professional teams are baseline tested could assist with buy-in towards implementation within amateur levels of the sport.

3.2.2. Theme 2. Contextual and operational factors

Factors relating to the context in which baseline testing was conducted, and the aspects that could affect testing on the day, played a role in participants' perceptions of the successful completion of the process.

3.2.2.1. Sub-theme: Logistics and human resourcing. Overall, baseline testing was described by some coaches and physiotherapists as requiring substantive time and logistical effort during the busy pre-season. This was further compounded by the human resource limitations for clubs and/or schools, which was seen as a barrier to expanding baseline testing to more teams:

You guys are asking us to give up a fair bit of time for this. And for the most part, I think most of us would be fine with it, I was fine with it. But having one or two people (from NZR) come out to help made that job, turned it from a six-hour job into a two-hour job, and that made a massive difference.

[(Physiotherapist)]

Some players also missed the allocated baseline testing sessions or only joined the team later in the season:

And then by the end of the year you've got five or six new boys because they just want to play social. And then how do you test those boys who've just come in? At that age it's not as serious. There's no set teams. They want to play. Some boys want to start playing half-way through the season.

[(Coach)]

Whilst some coaches reported baseline testing to be disruptive to training, most participants across stakeholder groups agreed baseline testing should be undertaken during training because players were already there. Participants recommended increasing human resources to support testing and to allow ample time to complete testing all teams.

3.2.2.2. Sub-theme: Administering the test. Despite the logistical and resource challenges, physiotherapists felt that baseline testing was an

easy and clear process. Prior to testing, a good explanation of the process and its goals acted as facilitators to the flow of the testing sessions. Physiotherapists felt that NZRCAT as a baseline tool was clear and easy to use. However, some participants felt that the administration of the baseline testing was sometimes affected by external factors, such as the timing of the testing which may have been influenced by players' fatigue levels at the point of testing, or the learning effect from previous exposure to the baseline testing:

I feel like it's sort of, depending on how you're feeling the day, like, you could be tired from the day, and you come and do it, and your score will be quite different from say if you are fresh

[(Player)]

I'd kind of done the test like three times already... So some of the questions I already knew, and I was able to prepare myself... they do have variation with the number ones, and the words and stuff. But for example, the months backwards...

[(Player)]

Physiotherapists suggested extra support for players with learning disabilities (e.g., dyslexia), and translating it to other languages may help improve the application of the baseline testing to a wider player demographic:

The other thing is the guys that didn't speak very good English. That was a real struggle because they couldn't remember the words because they probably...just translating it...That was really hard.

[(Physiotherapist)]

4. Discussion

To our knowledge, this study is the first to explore stakeholders' (coaches, players, and physiotherapists) perceptions of baseline testing in community rugby. Overall, these participants, as key stakeholders involved in the NZRCAT baseline testing process, perceived the value of baseline testing to be more important than the barriers experienced, and supported the use of baseline testing in the community rugby setting. Three themes were developed to reflect participants' perceptions of the value of baseline testing: 1) baseline testing facilitating a positive concussion culture; 2) baseline testing's role in positive perceptions of rugby and player safety and; 3) baseline testing's role in concussion management as part of the CMP.

Importantly, participants highlighted what appeared to be perhaps the 'unintended' or 'unexpected' consequences of baseline testing, as highly valuable. Firstly, participants included in this study perceived that the inclusion of pre-season baseline testing contributed to cultivating a positive concussion culture, as they believed it 'boosted' concussion knowledge, awareness and positive attitudes towards concussion.

Despite the emphasis on concussion education in the last decade, education strategies appear to have had unimpressive and variable effects on improving players' concussion knowledge or reporting behaviours, especially in the long term.²⁸ To address these challenges, it has been recommended that interventions should consider implementing concussion education programmes that integrate multiple different strategies, including inter-active learning opportunities, as well as targeting multiple levels/stakeholders within the sport system.^{28,29} Additionally, these programmes should be aimed at improving participants' long-term concussion knowledge, behaviours and attitudes towards concussion reporting. Baseline testing may be one such strategy in a consistent, multi-pronged (and iterative) educational approach. Knowledge is an important component of an individual's decision-making and subsequent behaviours.³⁰ Education should, therefore, provide information that either strengthens supportive beliefs, challenges opposing beliefs, or allows formation of new supportive beliefs.³¹ The findings suggest the importance of creating learning opportunities that also strengthen

concussion knowledge by providing impactful information that also explains the reasons for player welfare initiatives such as baseline testing.

In the development of the original SCAT, its goal is described as the creation of "a standardised tool that could be used for patient education as well as for physician assessment of sports concussion."³² Although described as one of its intended goals, the use of the SCAT as an educational tool has possibly been undervalued or overlooked. Although these references to patient education likely refer to the 'concussion injury advice' and 'concussion information' sections within the SCAT, the administration of SCAT as a baseline test may potentially act as an educational tool in other ways. For example, the NZRCAT does not contain 'concussion injury advice or information' sections. If considered as part of a multi-pronged education strategy, participation in baseline testing provides an inter-active, participatory, and personal experience, which may make it more memorable than passive education strategies.³³ It involves an evaluation of concussion symptoms and exposing the player to the possible symptoms of a concussion, which may aid in players' symptom awareness. The baseline test also includes assessment of cognitive function and dynamic balance, which may provide an understanding of the deficits they may experience post-concussion.^{12,20} Nonetheless, knowledge alone is not effective in driving safe concussion behaviour, and research has highlighted the need for strategies that target attitude and social norm changes in concussion management.³⁴

According to the Theory of Planned Behaviour (TPB), the likelihood of an individual engaging in a certain behaviour depends on his or her intention to engage in that behaviour.³¹ Factors that directly influence intentions to engage in a behaviour include the person's attitudes towards the behaviour, the person's perception of subjective group norms concerning the behaviour, and the extent to which the person perceives him or herself to have control over the behaviour.³¹ For example, favourable attitudes towards concussion reporting, positive influence of coaches and teammates and the perceived control of the concussion reporting behaviour have been identified as key factors associated with intentions to report a concussion.³⁵

In this study, apart from perceived knowledge and awareness gains, participants discussed the role baseline testing plays in driving favourable concussion attitudes, through the creation of a more positive concussion culture that encompasses players, medical and coaching staff and team management. Participants described baseline testing as having a safety role within their schools and clubs, contributing towards player welfare and safer concussion attitudes, similar to recent findings reported by Deuschle et al.²⁰ In this sense, baseline testing may have contributed to the 'normalisation' of concussion management, and may have demonstrated to players that coaching, medical and management staff, take concussion management seriously, which may in turn positively influence their concussion-related behaviours.

In addition, the creation of a supportive environment by coaches that facilitates favourable concussion attitudes in players cannot be emphasised enough.³⁵ Thus, all strategies that work towards creating positive culture within a team, changing negative stigma around concussion non-disclosure and adherence to safe return to play in rugby should be prioritised. Participants also believed that the inclusion of baseline testing shows that rugby, as a sport, takes player welfare seriously. This is especially pertinent considering the wide-spread public concerns around the consequences of concussion if not managed correctly.

The third theme described baseline testing's role in concussion management as part of the CMP. As baseline testing itself does not contain explicit concussion education for athletes, relaying information on the need to report symptoms and seek care, and the process to follow should the player sustain a suspected concussion are crucial additional components to include at the time of testing. In this sense, part of baseline testing's value in this study lay within its connection to NZR's CMP and the personal interaction with the player that the baseline test afford. In this study, baseline testing was highlighted as the first step

in a pathway that facilitates care and safe return to play. In contrast to a more 'reactive' approach to managing concussions (which would include the use of normative data only), pre-season baseline testing as part of the CMP was pro-active, enrolling players in a dedicated pathway, from the start of the season, should they need to utilise it at any point. A critical goal for NZR is that any player with a concussion is medically cleared before they return to contact training.¹¹ Engaging players in the CMP through a baseline assessment is an opportunity to ensure that players are aware of the process and what steps they need to follow should they sustain a concussion.

Apart from the perceived benefit of baseline testing, some participants felt that the value decreased if the scores were not used by healthcare professionals during the diagnosis and medical clearance visits of the CMP. Lack of clear communication pathways and perceptions that some general practitioners did not undertake assessments to the required standard were also raised as barriers. Future strategies should consider how the flow of information, and healthcare provider buy-in, may be supported in this respect. Furthermore, at the community level, NZR has mandatory stand-down periods for any players who are removed from the field for a suspected concussion; 21 days for players under 19, and 23 days for those 19 years or older. However, the mandatory stand-down period may impact players' decision to report symptoms in the future. Some physiotherapists and players suggested having the ability to modify the stand-down period when supported by a baseline assessment, may provide an incentive for players to continue to report symptoms. However, these cases should be assessed by a general practitioner who is familiar with concussions and the CMP.

Two themes related to stakeholders' perceptions of barriers and facilitators to the baseline testing process were derived from the data: 1) stakeholder buy-in as a critical driver of the baseline testing process and; 2) contextual and operational factors. Stakeholders' buy-in towards baseline testing acted as a key facilitator to the process. Belief in a programme's value has previously been identified as a critical component of adoption.²⁴ In this study, an existing understanding of the seriousness of concussion, or knowledge acquired through adjunctive education sessions or pre-season discussions, appeared to drive buy-in towards conducting baseline testing. Additionally, favourable attitudes towards concussion prevention, recognition and management meant greater buy-in towards the process. Individuals were more likely to put their best efforts into, or support baseline testing if they valued safety over winning, and acknowledged the importance of concussion management. Theoretically, interventions like the Popular Opinion Leader (POL) intervention, a multi-level strategy that has proven successful in a number of public health contexts, could assist in supporting a culture of player safety.³⁶ Respected individuals are sought out, enlisted, and trained to promote risk reduction and prevention amongst their social circles, in this case, school teams and clubs.³⁶ There is evidence to show that significant behavioural changes pertaining to favourable concussion management may spread to other individuals when several opinion leaders endorse and support them.³⁶ In this sense, professional players may act as potent agents of change. Community level players have previously identified that they would prefer to receive education from professional level players, as they value their experiences and look up to them as role models.³⁷

Several barriers for implementing baseline testing at the community level were highlighted. The most common was a lack of logistical and human support available within clubs and schools, resulting in increased perceived pre-season burden. The successful implementation of initiatives within community sport requires adequate capacity of implementers, organisational processes that support implementation, and leadership to drive the intervention.³⁸ Despite strong leadership shown by NZR towards driving baseline testing, the findings suggest that more supportive organisational systems are needed to implement baseline testing, particularly human resource support. Understanding the implementation context and ensuring that the initiative 'fits' within the

capabilities and resources of the specific setting,²³ are key considerations for the future of baseline testing and/or national rollout of the programme.

Finally, the recommendations of the 6th International Consensus Statement on Concussion in Sport hold important implications for the future of baseline testing and the CMP. Firstly, the SCAT5/Child SCAT5 has been updated to SCAT6/Child SCAT6 and it is recommended to use these tools in the acute phase, ideally within 72 h following injury to assist with evaluation and management.^{6,39} In reality, early access to primary care pathways is challenging for many community players, resulting in most players only being seen post-72 h. Except for the symptom scale, the SCAT6 may not be appropriate for use in guiding return-to-play decision-making beyond seven days post-injury.^{6,21} In response, the Sport Concussion Office Assessment Tool (SCOAT6/Child SCOAT6) was created to give healthcare professionals a standardised and age-appropriate clinical tool to assist with concussion evaluation in the subacute phase (more than 72 h post-injury).⁶ SCOAT6/Child SCOAT6 allows for serial evaluations in the weeks that follow the injury, guiding both return-to-learn and play decisions.⁶ Importantly, baseline SCAT/Child SCAT scores may assist with interpretation of recovery outcomes as it allows for comparison with the SCOAT6/Child SCOAT6.⁶ For the future of the CMP, SCOAT6/Child SCOAT6 may be important additions to consider. Our experiences and research as part of this project identified the time pressures general practitioners in primary care face for assessments, as well as their limited exposure to concussion injuries and some of the standardised assessment components found within SCAT.^{12,14} These challenges potentially hinder the use of SCOAT6/Child SCOAT6 within primary care and warrant further consideration and research.

This study has certain limitations. Only players who had sustained a concussion were included. Perceptions of those who did not sustain a concussion need to be explored. Similarly, perceptions of baseline testing may differ outside of the specific context of NZR's CMP. The findings are also specific to participant experiences of the NZRCAT. Future research should explore perceptions around other forms of baseline testing. Whilst the NZRCAT has not been validated as a separate tool, the individual components included in the NZRCAT were taken directly from the SCAT family of assessments, which have all been individually validated. We believe the ecological value of providing general practitioners with an abbreviated tool that is fit for purpose for the primary care environment is important and further research to validate the NZRCAT is warranted. In addition, future research should explore quantifiable changes in concussion knowledge, attitudes and behaviour in players who have completed baseline testing. Only one women's rugby player was included. The intention was to recruit reasonably equal numbers of men's and women's rugby participants. However, the women's season finished four weeks earlier than the men's season, which coincided with the end of term break, making recruitment challenging. Future research should include greater efforts to include women's experiences. Finally, in this study, themes were developed by considering the data set as whole, thus including data of coaches, physiotherapists and players. It is reasonable to assume that these three different stakeholder groups have varied levels of concussion knowledge influencing their perceptions of baseline testing. Whilst the meaning of these themes may have varied for different stakeholder groups, a strength of this paper is overarching themes that were identified across all stakeholder groups, highlighting their importance for this process. We believe that the inclusion of different stakeholder groups allows the study to provide a holistic view of participant experiences and perceptions of baseline testing in the community.

5. Conclusion

The study findings suggest that as the first step in the CMP, baseline testing plays an important role in the initial engagement of players in the concussion management process. Baseline testing appeared to provide additional benefits, including acting as an interactive education

tool and influencing a positive concussion culture within the team. These benefits may factor into decisions regarding the implementation of baseline testing. Contextual support for baseline testing, as well as inter-professional communication should be addressed to ensure sustainability.

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Confirmation of ethical compliance

Approval to conduct the study was granted by Otago University Human Research Ethics Committee (18/087).

CRedit authorship contribution statement

DS, SW, MB, GS and SJS were involved in conceptualising the overall study design. BC and MB were responsible for data coding. BC, MB and GS were responsible for analysis of the data. All authors were responsible for the interpretation of the analysis. All authors were involved in editing drafts of the manuscript.

Declaration of interest statement

At the time of the study, DS was employed by New Zealand Rugby.

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Appendix A. Supplementary data

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