Easy When Everyone is on Board": Implementing a Framework for Managing Concussions in New Zealand Secondary Schools

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ABSTRACT

We implemented a FRAmework for maNaging Concussions in 12 New Zealand secondary Schools (FRANCS) in 2022 and 2023. The aims of this study were to describe the characteristics of students with concussion utilising the framework and to assess the implementation outcomes as reported by the school stakeholders. Assistant research fellows (ARFs) met weekly with students with concussion, assessing the mechanism of injury and concussion-related symptoms. An implementation survey was administered to school staff at the end of each year. Demographic data, concussion characteristics, and implementation outcomes were summarised. Open-ended survey questions were analysed using content analysis. Eighty-two students (23 girls) diagnosed with a concussion met with the ARFs. Most concussions were sports related (89%). The *Mdn* (range) Concussion Symptom Score at the first and last meetings were 22/75 (0, 53, $n = 84$) and 6/75 (0, 55, $n = 31$) respectively. Twenty-one of 24 school stakeholder ratings suggested that FRANCS was successfully implemented, and 22 would use FRANCS beyond project completion. Support provided by the ARFs and FRANCS' processes were highly valued. Challenges included lack of time and inconsistent buy-in from some students, parents, staff, and coaches. FRANCS can be adapted to individual schools' contexts and buy-in, and good communication processes are needed from all members of the school community to sustain the processes.

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INTRODUCTION

Mild traumatic head injuries (concussions henceforth) in adolescents are a concern globally and in Aotearoa New Zealand (Theadom et al., 2020). Recent Accident Compensation Corporation (ACC, New Zealand's no-fault personal injury insurance scheme) data found that adolescents (≤ 19 years of age) accounted for 37% of all concussion claims over a 12-month period (Accident Compensation Corporation, 2022). Most adolescents who sustain a concussion recover within 14 days, and can return to learn with no or minimal academic support by 10 days (Putukian et al., 2023). Yet around one-third of adolescents have been identified with persistent post-concussion symptoms, defined as symptom-reporting extending beyond a four-week period (Schneider et al., 2021; Thomas et al., 2018; Zemek et al., 2016). Symptoms can include ongoing fatigue; heightened emotions that impact on concentration, school, and sport performance; and reduced overall quality of life (Valovich McLeod et al., 2017; Wan & Nasr, 2021).

Early, appropriate care and staged return to learning (RTL) and activity are critical for recovery following a concussion (Anderson et al., 2021; Davis et al., 2017; Kontos et al., 2020; Putukian et al., 2023). A systematic review suggested 13–56% of students with a concussion benefit from academic support, particularly those with higher acute symptom severity, longer symptom duration, migraine history, prior concussion (for males), younger age (less than 12 years old), high cognitive activity, and low or inappropriately high physical activity levels early after sports-related concussions (Putukian et al., 2023). RTL and return to sport (RTS) can occur in parallel (Patricios et al., 2023), but full RTL should precede unrestricted or full RTS (Accident Compensation Corporation, 2025; Post et al., 2021).

Academic support for RTL may include environmental adjustments (e.g., modified school attendance, rest breaks, limited screen time), physical adjustments (e.g., avoiding contact, collision, or falls), curriculum adjustments (e.g., extra time to complete or reduced assignments or homework), and testing adjustments (Fetta et al., 2023; Putukian et al., 2023). Yet academic adjustments and return-to-activity guidelines are implemented inconsistently in schools (Carson et al., 2014; Ha et al., 2020; Valovich McLeod et al., 2017). Teachers and school administrators often feel ill-equipped to implement RTL protocols (Romm et al., 2018). Findings from the New Zealand Rugby Concussion Community Initiative corroborate that graduated RTL guidelines were seldom implemented effectively in New Zealand secondary schools (Costa et al., 2024; Salmon et al., 2024), despite concussion-related guidelines being available from the New Zealand Ministry of Education (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019).

Countries such as Canada and the United States of America (USA) have developed online resources for teachers, school staff, and students, and have implemented concussion guidelines in schools (Doucette et al., 2016; Hachem et al., 2016). Similar work in online resource development has also been done in other countries (Robins et al., 2023). Facilitators for such guidelines included the appointment of a concussion policy lead at each school, ongoing education strategies for specific stakeholder groups, and schools fostering relationships with healthcare providers (Mylabathula et al., 2023). Challenges for RTL guidelines include lack of school policy and staff education and poor communication processes (Anderson et al., 2021; Fetta et al., 2023; Gioia, 2017; Shepherd et al., 2024). A framework for managing concussion in schools is needed to address the gap from evidence to practice in New Zealand.

We used a community-based participatory action research (CBPAR) approach (Savin-Baden & Howell-Jamjor, 2013) to co-design a framework for concussion management in schools (for a full protocol, please see Salmon et al., 2023). This was conducted in four phases (Figure 1). In Phase 1a (2021), we co-designed a pilot framework with stakeholders from six schools (Salmon et al., 2025); the next year, we implemented FRANCS with five secondary schools (Phase 1b), evaluated the processes, and refined the framework based on the results of the evaluations (Phase 2); during the third year, we implemented FRANCS in more schools to determine the transferability of the framework to other contexts (Phase 3), and undertook a second round of process evaluation at the end of that year (Phase 4).

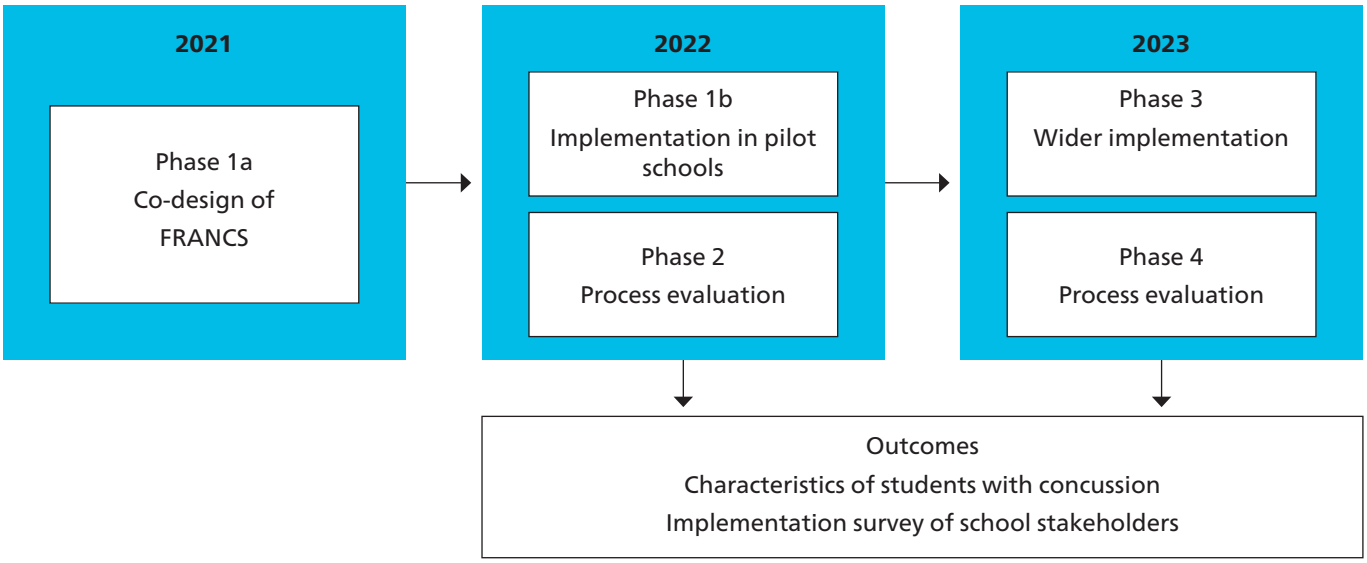
The research questions of this descriptive study were "What were the characteristics of student users of FRANCS during the implementation?" and "What were the school stakeholders' ratings of implementation outcomes?" Thus, the aims were, first, to describe the characteristics of students with concussion utilising the framework and, second, to assess the implementation outcomes as reported by the school stakeholders across the two years of implementation (2022/2023).

METHODS

We used a systems thinking (Hulme & Finch, 2015) and a realist process evaluation approach (Pawson et al., 2005) for this implementation study (Salmon et al., 2023). An iterative process of inquiry and analysis was used, exploring the implementation context, the mechanism by which FRANCS operated, and the characteristics and outcomes for students who sustained a concussion following the implementation of FRANCS (Prashanth et al., 2014). The University of Otago Human (Health) Ethics committee approved the study (reference number D23/046), and all participants (and

Figure 1

Development, Implementation, and Evaluation of Outcomes of the FRANCS



parents for students < 16 years old) signed written informed consent or gave verbal recorded consent.

Phase 1b – Recruitment of schools

For Phase 1a (2021), we had worked with a convenience sample of six schools in Auckland and Dunedin to co-design a framework for concussion support in secondary schools (Salmon et al., 2025). The schools had been part of the New Zealand Rugby Concussion Management Pathway and thus already had a working relationship with selected members of our team (Salmon et al., 2021). We approached their principals to determine availability to also participate in Phases 1b and 2 in 2022. Three schools in Otago agreed to take part. The two Auckland-based schools declined due to the complex post-COVID-19 environment. Two schools in Hawkes Bay were then invited and agreed to participate in Phases 1b and 2. The five school principals were approached again towards the end of that year to determine whether their school would be able to participate in Phases 3 and 4 in 2023.

Eighteen additional schools were approached to be included in Phases 3 and 4 to test the transferability of FRANCS. These were selected based on the geographical proximity to research team members, allowing regular visits to the schools. Seven schools agreed: two in the wider Dunedin metropolitan area, three in North Otago, one in Hawkes Bay, and one in Auckland. Twelve schools initially agreed to participate; however, one withdrew due to consequences of environmental flooding in Hawkes Bay in February 2023. Thus, 11 schools participated in Phases 3 and 4. In total, 12 schools contributed towards implementation and evaluation of FRANCS across the two years of the study.

An assistant research fellow (ARF) was appointed for each region (Auckland, Hawkes Bay, Dunedin, North Otago). Their responsibilities included liaising with schools, assisting with adapting the FRANCS framework to the individual school's contexts, supporting the school staff throughout the year, providing concussion education to stakeholder groups identified by each school, meeting on a weekly basis with students who had sustained a concussion, collecting demographic and concussion-related data, and leading interviews and focus groups throughout the year with key stakeholders.

Phase 1b – Recruitment of participants

School stakeholders included principals or rectors, teachers and deans, special needs coordinators, school administrators and nurses, and sports coordinators/directors. The principals forwarded names and contact emails of relevant school stakeholders the research team could liaise with. Selection of the stakeholders was thus based on the principals' judgement for the most suitable staff members. Central to FRANCS was the identification of a "concussion officer" within each school who could coordinate communication between family, students with concussion, the teaching and support staff, healthcare providers, and the research team (Salmon et al., 2025). The concussion officer could be a school nurse, administrator, teacher, or sports/coaching team member, depending on the school's existing processes.

The concussion officers were asked to forward project information to students who had sustained a concussion and their parents/caregivers and invite them to participate. Contact details of those who agreed were forwarded to the research team. Students (and their parents/guardians) were eligible to participate if they had sustained a suspected or confirmed concussion due to any mechanism, sustained either while at school or not.

Phase 1b – Implementation

Members of the research team worked with school representatives at the beginning of each year to discuss and

define implementation strategies, roles, and responsibilities of specific stakeholders, adapting the framework to each school's context. A process checklist (Appendix A) was provided to establish communication lines and key milestones for defining RTL and RTS processes in discussions among staff and coaches. ARFs met regularly with the key stakeholders until such processes were established and provided support throughout the year.

The ARFs consulted with key school stakeholders to determine convenient days and times for brief education sessions. These included presentations to students at school assemblies, parent evening meetings, sports coaches, and teachers at staff meetings, delivered by the ARFs using resources prepared by the research team. Schools were encouraged to share information about the study and FRANCS in regular parent newsletters throughout the year.

Phase 2 – Process evaluation

Throughout both school years, the ARFs collected data from consented students who had sustained a concussion and their parents/caregivers on a weekly basis until the student had successfully completed the RTL protocols. Where possible, the data included RTL and RTS time-points, mapping students' healthcare access (for example, assessment and/or sports clearance by GPs), and compliance with each aspect of the framework. Weekly symptom measures included the Concussion Symptom Severity Score of the New Zealand Rugby Sport Concussion Assessment Tool (Salmon et al., 2022). The Concussion Symptom Severity Score includes 25 symptoms rated on a 4-point Likert scale, with a total score of "75" indicating the maximal symptom severity and "0" indicating no symptoms. Research Electronic Data Capture (REDCap), hosted at the University of Otago, was used to collect the data. Once the student had fully returned to learning, the ARF invited them and their parents to an interview to determine their perspectives of the benefits and barriers of FRANCS. The analysis of these interviews will be reported in a subsequent paper.

As part of Phase 2, we developed an implementation survey with 5-point Likert-style questions, administered to key school stakeholders, evaluating key implementation outcomes (see Table 1 for outcomes' definitions, Proctor et al., 2011). Open-ended questions explored the stakeholders' responses to the Likert scale ratings. We invited school staff involved in the FRANCS implementation to complete the questionnaire via REDCap (Proctor et al., 2011). Descriptive demographic details of all school staff participants were captured.

Phase 3 – Intervention mapping for wider implementation

We revised FRANCS based on Phase 2 results. In 2023, we implemented the revised framework in the four schools that formed part of Phase 1b (the fifth school withdrew from the study due to environmental challenges), and seven additional schools to test the transferability of FRANCS.

Phase 4 – Second round process evaluation

We used the same process followed in Phase 2 to evaluate the implementation of FRANCS in the 12 schools that participated during the 2023 school year.

Statistical analysis

Demographic and concussion-related injury data of participants across both years were pooled and summarised (Phases 2 and 4). The number of sessions with the ARF, first and final Concussion Symptoms Severity Scores, and days from injury to the first and final sessions were compared between sexes using Mann Whitney U tests.

School stakeholder survey data of Phases 2 and 4 were also pooled and were analysed by providing the *Mdn* of the 5-point Likert scale and percentage of responses in the two most favourable ratings ("1", "2"). Content analysis was used to analyse open-ended responses (Graneheim & Lundman, 2004). Responses were coded inductively by one author and collated into potential categories and overarching themes. Themes were reviewed by the research team until final themes were defined and named. For each theme, barriers and facilitators for FRANCS were defined.

RESULTS

Schools

Characteristics of the 12 schools are outlined in Appendix B.

Students with concussion (Phases 1b and 3)

Demographic and concussion injury data, and Concussion Symptoms Severity scores were available for 82 students (57 boys, 25 girls; mean age 15.3 years, SD 1.7, range 12–18 years; Table 2). Two boys each incurred two concussions during the

Table 1

Evaluation Outcomes Assessed via Survey

Outcome	Definition
Acceptability	Satisfaction with the framework; content, complexity, comfort, delivery, and credibility
Appropriateness and feasibility	Perceived fit and actual fit; relevance; compatibility; suitability, usefulness; cultural responsiveness
Adoption	Uptake; initial implementation; intention to try
Fidelity	Degree of intended FRANCS implementation; adherence; quality of programme delivery
Penetration	Integration within school system, degree of adoption across schools
Sustainability	Extent to which FRANCS is maintained or institutionalised

Note. FRANCS = FRamework for maNagement of Concussion at Secondary Schools. Survey based on the work of Proctor et al. (2011).

study period, thus recording a total of 84 concussions. For 56% of the students, the reported concussion was their first. Around one-third of the students (37%) reported having had two or more prior concussions during their lifetime. Just over half (53%) of the concussions had occurred external to the school, and most (87%) were incurred while playing sports. Of the sports-related concussions, 62% had been incurred during rugby.

Around two-thirds of the students (65%) were seen by the ARF at school on a single occasion only, with one girl followed up weekly on five separate occasions. Around half of the cases (n = 42) were assessed by a medical doctor and five by physiotherapists, and that information was missing for 37 cases (44%).

Concussion outcomes (Phases 1b and 3)

The *Mdn* duration from the injury to the first visit was 13 days, with the maximum of 124 days for one student. Considering individual schools, it took between a *Mdn* of 7 days (School 3, Appendix B) and 26.5 days (School 12) for the first meeting with an ARF to occur. There was a large range of symptom severity throughout the monitoring period (Table 3, Figure 2). Compared to the boys, the girls attended more sessions, and reported higher symptom severity scores during the first session. For two students, their Concussion Symptom Severity Scores increased (regressed) from one assessment to the next; following this the ARFs informed the concussion officers and contacted the parents, strongly encouraging them to seek medical assessment for their child.

Implementation survey (Phases 2 and 4)

Twenty-three school stakeholders (mean age 50.0 years, SD 10.5; 17 females) completed the implementation survey, 10 at the end of 2022 (Phase 2), 12 at the end of 2023 (Phase 4), and one administrator during both years (24 survey entries). Most (n = 21) identified as New Zealand European (Pākehā), one as Tongan, and one as Australian. At least one stakeholder participated from each school: 10 sports directors (or coordinators), four administrators, two teachers and two deans, and one principal, deputy principal, physical education teacher, learning enhancement teacher, and school nurse. The implementation survey results are presented in Table 4.

Themes of open-ended question analysis

The following themes were identified from the open-ended implementation questions: (1) Existing policies and governance; (2) Buy-in and seeing value in the process; (3) Parent, student, and staff compliance; (4) Clarity of roles and responsibilities; (5) Reporting, communication, and awareness of process; (6) Resources, people, and time; (7) FRANCS process, resources, and education; and (8) Research team support and follow-up. These are described in Appendix C and as facilitators or barriers within the following implementation factors (Table 1).

Acceptability, appropriateness, and feasibility of FRANCS

FRANCS had high acceptability and was considered appropriate and feasible for schools (Likert scale *Mdn* of 1 or 2). Most found FRANCS was "easy" to implement (Question 1), useful (Question 2), and applicable (Question 3) for their school. The open-ended comments suggested that most of the schools had not had concussion processes prior to FRANCS (Appendix C). They valued buy-in from the school, parents, and students, and that FRANCS was a driver for student welfare following concussion. Processes were perceived to be clear and helped keep track of the students' recovery. The education sessions were considered helpful to improve concussion awareness and knowledge of various stakeholder groups. Barriers included clear processes not being established during the year of implementation, resources (staff and time), and lack of clarity around roles and responsibilities within the staff.

Adoption, fidelity, and penetration of FRANCS

Except for stakeholder compliance, the implementation attributes of adoption and fidelity were rated high (*Mdn* of 1 or 2). Most suggested they had sufficient resources and support for the implementation (Questions 5, 6). Twenty-one stakeholders found that FRANCS was "mostly" or "completely" successfully implemented (Question 7). Student (Question 9) and parent (Question 11) compliance had the least favourable scores (medians 3, "neither easy or difficult"), suggesting that penetration had not been achieved consistently.

Barriers included remaining challenges for reporting and communication pathways, resource and time challenges, and buy-in from various stakeholders. Suspected non-reporting of concussions by students or their parents, lack of feedback from the student or parents when they had been cleared by a healthcare provider or from teachers to the concussion officer about the students' progress, and lack of understanding of the possible serious consequences of premature RTL and physical activity still appeared to prevail. Finding times to check in with the students on a weekly basis was challenging. Lack of agreement around stand-down periods between different sports posed ongoing challenges.

Facilitators included an established caring student welfare environment within the school. Schools that already had an established support network, functioning internal communication processes, and that knew their students well (perhaps as in smaller schools) appeared to have found implementation easier. While implementation was "easy, straight-forward", sustaining FRANCS was dependent on sufficient staff availability. Having a school nurse on location was considered beneficial for implementation. Overall, the stakeholders appeared to report enhanced awareness of concussion and processes for gradual RTL and RTS.

Sustainability of FRANCS

Twenty-two stakeholders from 11 of the 12 schools reported they would use FRANCS beyond project completion, suggesting possible high sustainability (Question 12). Most comments suggested the framework was important for student welfare and it highlighted the seriousness of concussion to various stakeholder groups, largely improving buy-in. The process appeared to have helped some to keep track of students with concussion.

Table 2

Demographic and Concussion Characteristics of Students Progressing Through FRANCS

Demographics and concussion characteristics	*n*	%
Sex: Girls, boys	25, 57	30.5, 69.5
Ethnicity [a]		
New Zealand European/Pākehā	69	84.1
Māori	8	9.6
Pasifika	6	7.4
Other	7	8.5
Not declared/missing data	4	4.9
School year (*n* = 82)		
Up to and including Year 8	8	9.6
Year 9	15	18.5
Year 10	13	16.0
Year 11	13	16.0
Year 12	18	22.2
Year 13	14	17.3
Number of assessments with the research fellows (*n* = 84 concussions)		
1	46	55.4
2	24	28.9
3	8	9.6
4	3	3.6
5	2	2.4
Number of previous concussions during lifetime (*n* = 82)		
0	46	56.1
1	7	8.5
2 or 3	23	28.0
4 to 7	6	7.3
Missing data	1	1.2
Number of concussions during past 12 months (*n* = 82)		
0	64	78.0
1	9	11.0
2	7	8.5
3	1	1.2
Missing data	1	1.2
Location of current concussion (*n* = 84)		
External to school	43	53.1
At school	38	46.9
Missing data	3	3.6
Sports-related injury (*n* = 84)		
Yes	72	88.9
No	9	11.1
Missing data	3	3.6
Sports (*n* = 72)		
Rugby	44	61.1
Hockey	8	11.1
Football	5	6.9
Basketball	4	5.6
Waterpolo	3	4.2
Martial arts	3	4.2
Other (mountain biking, netball)	4	5.6
Missing data	1	1.4

[a] More than one ethnicity can be selected, thus total is > 82.

Table 3

Number of Assessments, Timepoints, and Concussion Symptom Severity Scores

Characteristic	All			Boys			Girls			*p*
	Mdn	Range	*n*	*Mdn*	Range	*n*	*Mdn*	Range	*n*	
Number of assessments	1.0	1, 5		1.0	1, 3		2.0	1, 5		0.003
Days from injury to baseline assessment	13.0	2, 124	82	12.5	2, 39	57	10.0	3, 55	25	0.503
Baseline CSSS [a]	22.0	0, 53	84	13.8	0, 53	59	30.0	9, 48	25	0.003
Days from injury to final assessment	27.0	11, 96	31	20.0	11, 48	18	41.0	14, 96	13	0.003
Final CSSS [b]	5.0	0, 55	31	4.5	0, 47	18	6.0	1, 55	13	0.523

Note. CSSS = Concussion Symptom Severity Score, with 25 questions rated on a 4-point Likert scale (0 = no symptoms; 75 = highest symptom level).
[a] Counts related to number of concussion cases (two males had two concussions each). [b] Includes only those with more than one assessment.

Figure 2

Concussion Symptom Severity Scores for Individual Participants (n = *84 concussions)*

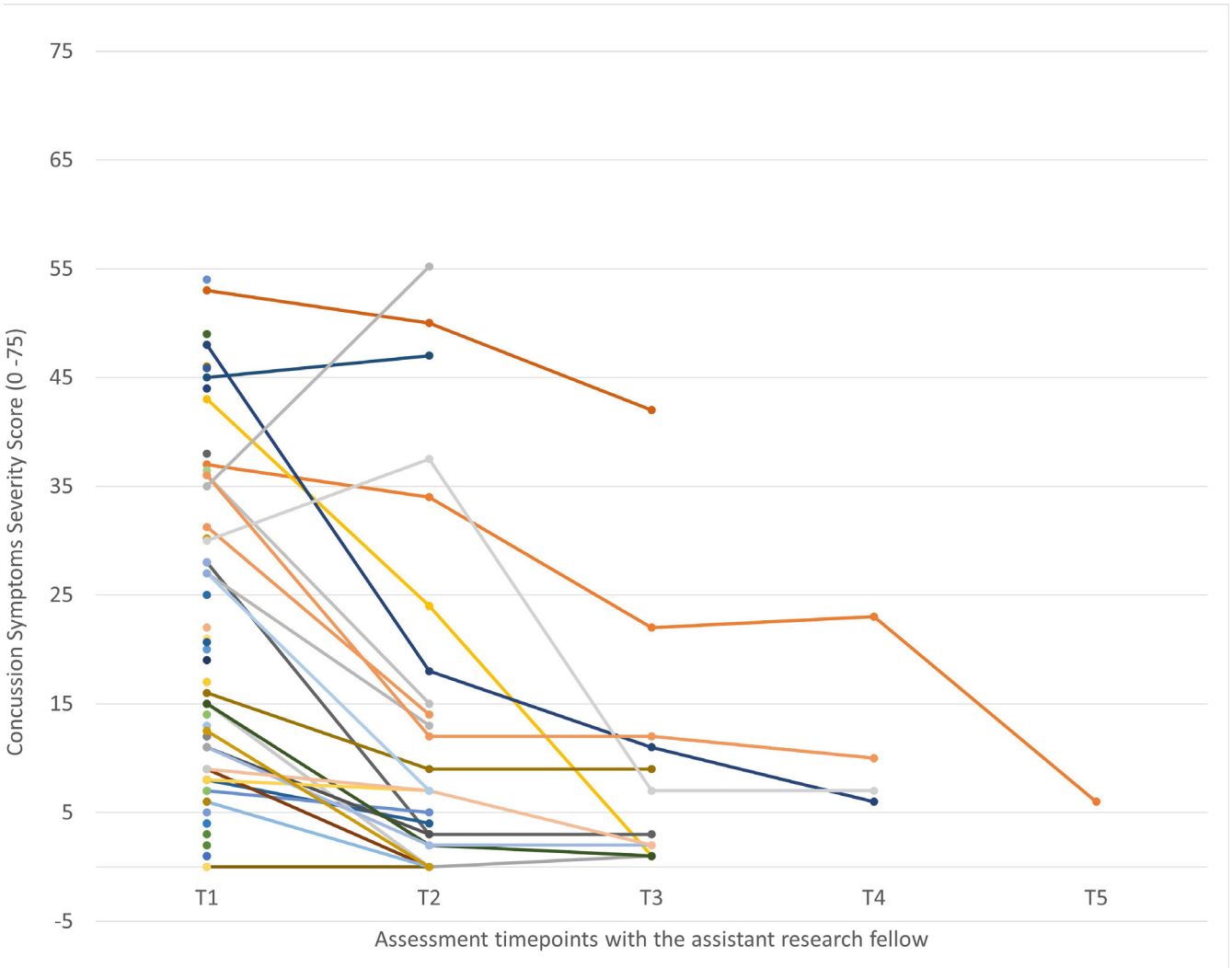


Table 4

Results of the Implementation Survey (n = *24 completed surveys)*

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
A. Acceptability, appropriateness, and feasibility				
1. Implementation ease: Overall, how easy or difficult was it to get FRANCS implemented in your school?	Extremely easy	7	2 (1, 3)	– Buy-in and seeing value in the process (B/F) – Resource, people, and time (B/F) – FRANCS process, resources, and education (F) – Support and follow-up from Research Fellows (F) – Concussion reporting, communication, and awareness of process (B) – Existing policies and governance (B) – Clarity around roles and responsibilities (B)
	Easy	11		
	Neither easy nor difficult	6		
	Difficult	0		
	Extremely difficult	0		
2. Usefulness: Do you think FRANCS is useful for managing concussion in your school?	Yes, completely	20	1 (1, 3)	
	Mostly	2		
	Unsure	2		
	Not completely	0		
	Not at all	0		
3. Applicability: Do you think FRANCS worked well/was applicable for all students? (students of any grade level, ethnicity or gender)	Yes, completely	17	1 (1, 3)	
	Mostly	6		
	Unsure	1		
	Not completely	0		
	Not at all	0		
4. Fit: Did you have to make any changes to FRANCS to get it to fit/ make it acceptable to your school?	Not at all	11	2 (1, 4)	
	A little	8		
	Unsure	4		
	Somewhat	1		
	A lot	0		

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
B. Adoption, fidelity, and penetration				
5. Resources: Did your school have sufficient resources (staff / financial / expertise) for the implementation of FRANCS?	Yes, completely	10	2 (1, 4)	– Buy-in and seeing value (B/F) – Support and follow-up from research fellows (F) – Resources, people, and time (B/F) – FRANCS process, resources, and education – Concussion reporting, communication, and awareness of the process (B/F) – Compliance from parents and students (B) – Existing policies and governance (B) – Clarity around roles and responsibilities (B)
	Mostly	10		
	Unsure	2		
	Not completely	2		
	Not at all	0		
6. Support: Did you receive sufficient support to implement FRANCS in your school?	Yes, completely	18	1 (1, 3)	
	Mostly	4		
	Unsure	2		
	Not completely	0		
	Not at all	0		
7. Implementation success: Do you think FRANCS was successfully implemented in your school (i.e., getting FRANCS up and running in your school)?	Completely	8	2 (1, 4)	
	Mostly	13		
	Unsure	2		
	Not completely	1		
	Not at all	0		
8. Extent: To what extent did the school use FRANCS for the management of concussion?	Completely, used all aspects	10	2 (1, 3)	
	Partially, used most aspects	12		
	Unsure	2		
	Some, used some aspects	0		
	Never used FRANCS	0		

Implementation factor	Likert Scale	*n*	*Mdn* (min, max)	Open-ended question analysis main themes [a]
9. Students' compliance: How easy or difficult was it to get students to follow and comply with FRANCS?	Extremely easy	4	3 (1, 5)	
	Easy	6		
	Neither easy nor difficult	12		
	Difficult	1		
	Extremely difficult	1		
10. Staff compliance: How easy or difficult was it to get school staff to follow and comply with FRANCS?	Extremely easy	5	2 (1, 4)	
	Easy	9		
	Neither easy nor difficult	8		
	Difficult	1		
	Extremely difficult	1		
11. Parents' compliance: How easy or difficult was it to get parents to follow and comply with FRANCS?	Extremely easy	2	3 (1, 4)	
	Easy	6		
	Neither easy nor difficult	14		
	Difficult	2		
	Extremely difficult	0		
C. Sustainability				
12. Future Use: Do you think FRANCS will still be used in your school after completion of the research project?	Yes, completely		1 (1, 3)	– Buy-in and seeing value in the process (B/F)
	Mostly			
	Unsure			
	Not completely			
	Not at all			

Note. B = barriers; F = facilitators; FRANCS = FRamework for maNagement of Concussion at Secondary Schools.

[a] See Appendix C for description of themes.

DISCUSSION

We previously used CBPAR to co-design a framework for implementing concussion support in secondary schools (Phase 1b, Salmon et al., 2025). In this paper we profiled students with concussion across 12 schools and determined implementation outcomes, rated by the school stakeholders. Across the two years, 84 concussions (82 students) were reported and managed using the framework. Girls accounted for 30% of the participants, reported significantly higher Concussion Symptom Severity Scores during their first assessment, and generally attended more follow-up sessions with the ARF than the boys.

We had planned to meet with students with suspected concussion within the first week following the injury. However, the first meeting with the ARF was a median 13 days following the injury, with a maximum time just over 17 weeks for one student, challenging the fidelity and penetration of implementation of the follow-up assessments. The timing of assessments was challenged by delayed self-report, logistical issues for matching the ARF's availability with the students' school timetable, and the only communication mode with students being via text or emails when they had been instructed to limit screen time following their concussion. Possible concussion-related forgetfulness may have contributed to non-attendance of some sessions. It is also possible the students did not understand the seriousness of concussion, and thus may have lacked motivation.

Fifty-eight cases of concussion (69%) had Concussion Symptom Severity Scores up to 25/75, suggesting on average they had no or "mild" symptoms. Most students were thus near-symptom resolution when meeting with the ARF for the first time. On the other hand, "moderate' (average 26 – 50/75, 28.6% of cases) and "severe" (above 50/75, 2.9% of cases) scores for some students are concerning. Adolescents with concussion are at increased odds of reporting poor mental health and, particularly males, having two or more concussions within 12 months have greater odds of reporting suicidal attempts compared to students reporting one concussive event (Kay et al., 2023). Post-traumatic amnesia, sleep quality, and depression are associated with recovery in adolescents (Wilmoth et al., 2022). Anti-social behaviour has also been described in about one-third of people with long-term post-concussion symptoms in a New Zealand community cohort (Theadom et al., 2024). Taking longer than one month to recover post-concussion also predicted exiting the workforce due to the injury within four years, nearly one fifth of people in another cohort study (Theadom et al., 2017). In turn, exiting the workforce following concussion can have a significant impact on the labour market (Fouquet et al., 2024).

It is critical to identify and implement care and support for this smaller, but significant (~ 30%), group of adolescents who are at risk of having an ongoing burden in terms of symptoms, psycho-social consequences, cognitive and learning ability, and, potentially inability to enter and maintain the workforce after experiencing a concussion. Teachers and school support staff could contribute towards improving post-concussion outcomes, not only in terms of short-term RTL and RTS, but also in the longer term to enhance employability of the student beyond their secondary school years. Informed teachers, sports coaches, and school personnel could identify such students at risk based on symptoms complaints, and possible changed behaviour, academic performance, or physical performance, for example during physical education classes or sports training. Besides implementing learning support, school personnel could also have an important role of prompting parents or guardians to organise and attend medical doctor appointments for diagnosis and clearance if their child had a suspected concussion.

Implementation

Despite the challenges of arranging timely meetings with students post-concussion and documenting recovery timepoints, FRANCS appeared to be "easy" to implement and adopt, based on the school staff implementation survey. Based on the open-ended questions of the implementation survey, school stakeholders appreciated the support of the ARFs, suggesting that external support may be needed to assist schools to implement and maintain FRANCS. Specifically, the ARFs met with school staff at the beginning of the year to modify the process for the specific schools' context and resources. The ARFs also provided education sessions and regular follow-up with students, which in future would need to be sustained by school staff.

More work is needed to improve stakeholder buy-in and seeing value in the process (thereby enhancing penetration), including from the school leadership team, administrators, teachers in daily contact with students, coaches, and parents (Proctor et al., 2011). Engagement with staff and parents was inconsistent across the schools, and there appeared to be a remaining lack of understanding of the potential seriousness of concussion despite education sessions, as has been reported internationally (Mylabathula et al., 2023). Provision of study information to students was dependent on support by each school's concussion officer, whose role appeared critical for the success of the implementation.

Varied and continued delivery methods of concussion education and resources are required to address the multiple stakeholders who can influence and support the adolescents' concussion recovery (Mallory et al., 2022). Repeated education sessions may be needed throughout the year, particularly due to high turnover rate of staff, and parents often engaging only when their child had a concussion. Didactic education sessions can be considered to be providing information "just in case", which may generate low interest or uptake and may explain low compliance reported for parents and students. To complement those education strategies, resources that are accessible for school staff, parents, and students are needed to provide information and guidance "just in time" (right time and right place, Chueh & Barnett, 1997; McGowan et al., 2008). "Just in time" training includes relevant information being accessible when a specific student has experienced a suspected concussion. While online concussion resources for New Zealand schools are available (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019),

our findings suggest awareness of these was low. Reminders of such resources and of the schools' processes may be needed at student assemblies, parent newsletters, and staff and coaching meetings throughout the school year. Recent changes in ACC guidelines for a uniform stand-down period following concussion across all sports are likely to decrease the challenge faced by school staff with implementing these (Accident Compensation Corporation, 2025).

The project was undertaken in the immediate post-COVID period (2022/2023), where high student absenteeism and increased staff sick leave and turnover created implementation challenges. Schools are complex systems with multiple stakeholders, where concussion education and support may not always be a priority. In February 2023, devastating floods in Auckland and Hawkes Bay further required schools to allocate staff and logistical resources to urgent needs. Schools face competing demands for adolescent wellbeing support, including mental health education, smoking and vaping prevention, sexuality and relationships education, and bullying prevention. In the USA, research indicates students who had tried cigarette smoking, used an electronic vapour product, or considered suicide experienced a higher prevalence of sports-related concussions compared to peers who had not (Sarmiento et al., 2023). Balancing the priority of concussion education and support within the complex and resource-constrained school environment remains challenging, especially with growing expectations to deliver extensive wellbeing education in an already crowded curriculum.

Methodological considerations

The development and implementation of FRANCS was based on co-design with school stakeholders, thus "by" schools "for" New Zealand schools (Salmon et al., 2025). We included 12 schools from three different geographical areas across socioeconomic levels, including one in a rural settlement. However, the study design did not allow us to determine the actual incidence of concussion in the schools; thus, the compliance or reporting could not be determined. The relative participation of Māori and Pasifika students was 9.6% and 7.4% respectively. ACC concussion statistics suggest that concussion claims by Māori contributed towards 17.6% and for Pasifika 7.2% of all claims for the age group up to 19 years. Despite including four schools with a Māori student ratio greater than 17%, Māori, in particular, were under-represented in the FRANCS project. Enhanced involvement by Māori stakeholders to improve access to and equity for concussion prevention and management is needed. Although we had planned to define healthcare access, and RTL and RTS timepoints for each student with concussion (Salmon et al., 2023), this proved to be difficult as more than half of the participants attended only one session with the ARF. The implementation survey did not allow depth of analysis, and results of qualitative interviews will complement the results in a future paper.

Implications

Parents' and coaches' attitudes towards concussion can influence students' timely self-reporting of their concussion (Warmath et al., 2022). Reporting a concussion promptly is crucial for initiating individual RTL and RTS plans. Continued education strategies across the school year ("just-in-case") and accessible resources ("just-in-time") are needed to improve concussion awareness and attitudes of students, teaching and support staff, coaches, and parents. Improving school staff ability to identify and support students with possible concussion-related behavioural issues and symptoms, as well as those with mental wellness challenges (Sarmiento et al., 2023), would be of benefit for the overall wellbeing of students. Future research is needed to explore the effectiveness of FRANCS to improve concussion outcomes in schools in the longer term. Specifically, continued CBPAR is needed to enhance involvement and access to support by Māori and Pasifika students and their whānau/aiga. Further strategies are needed to improve engagement within schools and to prepare for a national roll-out.

CONCLUSION

We implemented a FRANCS across 12 schools over two years, capturing data of 82 students with concussion. Most concussions were sports-related and 21 of 24 school stakeholders rated FRANCS as successfully implemented, and 22 (from 11 of the 12 schools) would use FRANCS beyond project completion. Support provided by the ARFs and FRANCS' processes were highly valued. Challenges included lack of time and inconsistent buy-in from some students, parents, staff, and coaches. FRANCS can be adapted to individual schools' contexts and buy-in, and good communication processes are needed from all members of the school community to sustain the processes.

KEY POINTS

1. We implemented a FRANCS in 12 schools across Aotearoa New Zealand.
2. Eighty-two students reported their concussion and were monitored by a concussion officer in each school and by an assistant research fellow.
3. The concussion officer passed information to relevant teachers to implement a return to learn process.
4. School stakeholders completed an implementation survey at the end of each of the two years, and most suggested that they would continue using the framework in future.

DISCLOSURES

This study was funded by a Lottery Health Grant. The authors declare no other conflict of interest.

PERMISSIONS

This study was approved by the University of Otago Human Ethics Committee (reference number D23/046).

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CONTRIBUTIONS OF AUTHORS

Conceptualisation and methodology, DS, MB, KM, SW, SK, and GS; formal analysis, GS, DS, and MB; interpretation, all; writing – original draft preparation, GS, MB, and RC; writing – review and editing, all; data curation and project administration, GS, CS, RC, KM, MB, and AZ.

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Appendix A

IMPLEMENTATION PLANNING CHECKLIST FOR SCHOOLS

Checklist	Name	Notes
1. Identifying key stakeholders		
Stakeholders involved in initial implementation of FRANCS (driving team) For example, school principal, director of sports, school nurse Available stakeholders to be involved in concussion management responsibilities in school. For example deans, nurses, health and safety committee, sport coordinator		
2. Other resources available		
For example, school clinic – how may this be utilised as part of FRANCS; or specific communication platforms; or networks/ relationships; or people that can help support		
3. Key responsibilities	Assigned to [role; name(s)]	Notes/How will this be done?
– Designation of concussion officer(s) role within the school. *"Who oversees concussion management?"* (Responsibilities of concussion manager contained in the FRANCS guideline book) – Ensuring all relevant stakeholders understand their responsibilities – Establish a direct way of reporting concussion (e.g., specific email address concussion@…school.nz, which is linked to the concussion officer's email). *"How is concussion going to be reported?"* – Activate an automated email response linked to the reporting email address, providing the person reporting the concussion with immediate advice (template for this email provided by research team). *"How will concussion notification/advice be shared?"* – Identifying and reporting responsibilities communicated to all coaches/manger/parents. *"Does everyone know how to report concussion?"* – Organisation of appropriate medical treatment. *"How/when will students see doctor?"* – What other health provider is involved, such as a physiotherapist or a member of the concussion service? *"Who will communicate with that provider, if needed?"* – Develop a communication plan that includes all relevant stakeholders. *"How will all teachers, parents, coaches be informed of concussion/stand down?"* – Activating and documenting a tailored return to learn plan (accommodations, etc). *"Who manages academic accommodations?"* – Monitoring students' return to learn. *"Who checks in on student?" "How are students to be tracked and reported?"* – Making educational content provided as part of FRANCS accessible to all stakeholders within schools (i.e., concussion cards for coaches, educational resources for parents, students, etc.)		

Note. FRANCS = Framework for maNagement of Concussion at Secondary Schools.

Appendix B

SCHOOL DEMOGRAPHIC DATA

School ID	Phases 1b, 2 (2022)	Phases 3, 4 (2023)	Gender	Student *n*	Decile/ equity index [a]	Ethnicity [b]				Urban/rural [c]
						Māori	Pasifika	European/ Pākehā	Other	
1	✔		G	565	3/506	51.7	29.6	37.7	11.2	Large urban
2	✔	✔	G	314	4/394	10.8	0	92.4	7.1	Medium urban
3	✔	✔	B	845	7/457	20.2	7.9	73.1	14.9	Major urban
4	✔	✔	G	714	8/434	15.0	6.6	76.6	19.1	Major urban
5	✔	✔	B	514	10/386	10.9	1.6	89.5	11.5	Major urban
6		✔	B	526	9/396	12.4	1.7	85.9	9.9	Large urban
7		✔	G	1,567	10/NA	3.0	5.0	48.8	48.8	Major urban
8		✔	B/G	1,218	7/455	16.3	2.3	90.7	6.2	Medium urban
9		✔	B/G	678	8/429	14.2	7.2	71.5	22.7	Major urban
10		✔	B/G	149	6/483	28.2	5.4	90.6	4.7	Rural settlement
11		✔	G	371	6/480	12.4	12.7	83.3	6.5	Medium urban
12		✔	B	379	6/485	19.3	12.9	73.6	5.3	Medium urban

Note. B = boys; G = girls; NA = not applicable.

[a] Decile: Measures the extent to which students live in low socioeconomic communities. Decile 1 schools are the 10% of schools with the highest proportion of students from low socioeconomic communities; this measurement was last used in 2022. Equity index: Measures the extent to which a school draws its children from low socioeconomic communities and is used to determine a school's level of government equity funding (since 2023). A higher index indicates a higher proportion of students facing socioeconomic challenges (Willis, 2024). [b] Ethnicity: Students who are affiliated in more than one ethnic group are counted in each ethnic group. [c] Based on to data from Stats NZ (2023).

Appendix C

OPEN-ENDED SURVEY ANALYSIS: DESCRIPTION OF THEMES

Theme	Implementation factor	Summary of facilitators and barriers
Existing policies and governance	A, B	Facilitator Schools that are already following some similar processes. Barrier Policies or processes are difficult to ratify, implemented as a guideline instead. Difficulty with sports with different return to sports periods.
Buy-in and seeing value in the process	A, B, C	Facilitator School staff seeing value in improved management of students, structured. process, clear reporting system, important for health and wellbeing of students, improved follow-up and record keeping. Schools not having concussion processes prior to the project and see the need/importance of having a structured process in place. FRANCS provided authority to manage students appropriately (against push-back attitudes from parents/students). FRANCS education and resources were useful, simple way to improve knowledge. Easy when everyone is on board. Enhanced parent, coaches, student, and teacher concussion knowledge; staff taking concussion seriously. Buy-in from school staff who are passionate about welfare, see it as their duty of care.

Theme	Implementation factor	Summary of facilitators and barriers
		Barrier Some modifications required to optimise success of FRANCS, needed more input from key staff. Lack of buy-in at governance level, or lack of buy-in in individual sports. Unsure if FRANCS is valuable; value will only really be determined once study results are available, or more is known, or staff did not have enough involvement to comment.
Parent, student and staff compliance	B	Barrier Easy to implement but may be difficult for staff to maintain FRANCS. Parents not taking concussion seriously and wanting their children to return to sport, students desire to get back playing sport too soon. Students' compliance to process and pushing to return.
Clarity of roles and responsibilities	A, B	Barrier Lack of clarity, responsibilities not assigned around FRANCS process. Students unclear on what their responsibilities are as part of process.
Reporting, communication, and awareness of process	A, B	Facilitator Staff awareness of process. Strong lines of communication across staff and parents. Recording approach employed by school that facilitates communication to all relevant stakeholders. Barrier Students/coaches/parents not reporting or communicating about concussion, concussions sustained outside of school. If no centralised form for documenting concussions, and just using paper incident reports, or emails result in another step that must be completed – concussions are not always captured/recorded. Not keeping records up to date, or not closing cases if recovered. Difficulties with clear lines of communication/methods of communicating. Communication not always reaching relevant teachers/staff. Not all staff or sports team members familiarised with the processes, including recording students with concussion. Communication from doctors: Left to students to communicate plan back to the school.
Resources, people, and time	A, B	Facilitator Existing support systems: Having a school nurse/medic that can help facilitate process, supportive environment, existing good connection with students regarding their wellbeing. Close-knit/small school, knowing the parents, involved coaches. Barrier Human resources: Time challenges of staff, staff with multiple roles. Finding time to catch up with students and parents, informing staff of the processes.
FRANCS process, resources, and education	A, B	Facilitator Easy straightforward process, resources and templates. Concussion awareness and knowledge through education.
Research team support and follow-up	A, B	Facilitator (major) Support from project team following up with students and parents. Direction, support, and communication from project team given to school. Barrier Needed more guidance regarding the process.

Note. A = acceptability, appropriateness, and feasibility; B = adoption, fidelity, and penetration; C = sustainability.