Designing, Implementing, and Evaluating a Framework for Managing Concussions in Aotearoa New Zealand Secondary Schools: A Study Protocol

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ABSTRACT

Adolescent concussions can potentially lead to cognitive and behavioural changes, affecting concentration and performance at school and in other activities. Although the Ministry of Education provides web-based guidelines for post-concussion student support, the implementation of these in the school setting is limited. Due to the complex school environment, a pragmatic methodology is needed to co-design implementation with relevant community stakeholders. We outline the protocol for designing and implementing a FRAmework for maNaging Concussions in New Zealand Secondary Schools (FRANCS) to support safe return to learn and activity for students. The framework draft was co-designed by school stakeholders and will be refined at organisational levels. We describe the theoretical underpinnings that informed the study design and outline the project phases. We use a systems thinking approach, Community Based Participatory Action Research, and Appreciative Inquiry approaches to co-develop FRANCS with community, policy, and professional stakeholders. The implementation and evaluation phases of FRANCS is guided by Step 5 of the Intervention Mapping protocol, Implementation outcomes, and Realist process evaluation. FRANCS will be adaptable to the context of individual secondary schools in Aotearoa New Zealand, ensuring that return-to-learning and -activity guides are implemented to support students who have sustained a concussion.

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INTRODUCTION

Concussions are a serious health concern in Aotearoa New Zealand, with the highest rates reported for adolescents (Theadom et al., 2020). Recent 12-month statistics suggest that 37% of all concussion claims accepted by the Accident Compensation Corporation (ACC, Aotearoa New Zealand's no-fault personal injury insurance scheme) were incurred in the age group ≤ 19 years. In this young age group, 45% were incurred during sports, with close to 40% of these sports-related concussions sustained in rugby union (Accident Compensation Corporation, 2022).

Most adolescents with a concussion recover within 4 weeks, but 26% have persistent symptoms (Thomas et al., 2018). Such symptoms can lead to ongoing fatigue, influence emotions, and reduce concentration, school and sport participation, and performance, and overall quality of life (Valovich McLeod, Wagner et al., 2017; Wan & Nasr, 2021). Early, appropriate care and staged return to learning and activity is critical for recovery following a concussion (Anderson et al., 2021; Davis et al., 2017; Kontos et al., 2020). However, teachers and school administrators often feel ill-equipped to implement return-to-learn protocols (Romm et al., 2018). Cognitive rest, academic adjustments, and return-to-activity guidelines are implemented inconsistently (Carson et al., 2014; Ha et al., 2020; Valovich McLeod, Lewis et al., 2017). Findings from the New Zealand Rugby Community Concussion Management Pathway initiative (Salmon et al., 2020) corroborate such observations, namely that interviewed stakeholders suggested that graduated return-to-learn guidelines were seldom implemented effectively in schools. Although the Te Tāhuhu o te Mātauranga – Ministry of Education provides web-based information and guidelines about concussion, there little evidence of its adoption in schools (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019).

Countries such as Canada and the United States of America (USA) have successfully developed and implemented such guidelines in schools (Doucette et al., 2016; Hachem et al., 2016; Robins et al., 2023; Williamson et al., 2014). A Canadian national charity for injury prevention, Parachute,™ provides concussion awareness training tools (CATT) for healthcare and education professionals, sports organisations, students, and parents (Parachute, 2022). A framework outlining the "what", "where", "who", and "how" for managing concussion in schools is needed to address the knowledge translation gap from evidence to practice in Aotearoa New Zealand. Such a framework must be suitable and adaptable for the Aotearoa New Zealand context. It should be developed in partnership and with collective responsibility with the secondary school community, and aim to improve health-care access and outcomes for Māori, Pasifika, and other equity groups (Carlson, 2019).

The aim of this protocol paper is to describe the methodological underpinnings that informed this project, then to outline the project phases. The overarching purpose of the project is to develop a FRAmework for maNaging Concussions in New Zealand Secondary Schools (FRANCS) to support safe return-to-learn and -activity for all students. FRANCS was co-designed by school stakeholders and refined at organisational levels.

The objectives of this project are:

1. To co-design and implement a FRANCS with a pilot group of Aotearoa New Zealand secondary schools and relevant stakeholders (Phase 1a/b).
2. To evaluate FRANCS in those schools (Phase 2).
3. To refine FRANCS based on the implementation outcomes and process evaluation findings (Phase 3).
4. To determine the transferability of the framework to other contexts (Phase 4).
5. To develop recommendations and targeted strategies to implement FRANCS in a wider range of schools across Aotearoa New Zealand (Phase 5).

METHODOLOGICAL UNDERPINNINGS

We employed a systems thinking approach (Hulme & Finch, 2015) to co-design, implement, and evaluate the FRANCS in the schools and the wider community. Figure 1 presents the theoretical approaches informing the study design, and the five phases of the project. We completed phases 1a/b and 2 in 2021 and 2022, and are undertaking Phases 3 to 5 in 2023.

Systems thinking applied to schools

A systems thinking approach considers the system as a whole as opposed to individual components (Hulme & Finch, 2015). Multiple relationships or interactions between persons or processes lead to complexity within the system (Hulme & Finch, 2015). Such systems' interactions are non-linear: change in one component can result in either a negligible or a large effect on the system as a whole (Walton, 2014).

A school is a complex system, existing within a multi-ethnic and culturally diverse society, with substantial interactions between many interrelated "sub-components". These sub-components include the people, policy, curricula, reporting structures, physical environments, and socio-cultural and -economic contexts. The people include teaching staff, school leadership, ancillary staff, students, parents/kaitiaki (caregivers), whānau, coaches, other schools, the wider community, and external role players (i.e., law, curriculum, and policy makers) (Clacy et al., 2017; Hawkins & James, 2018; Hulme et al., 2019; Walton, 2014). The development and implementation of FRANCS needs to take into consideration such complexity of the school environment due to the different sub-components, stakeholders, and their respective behaviours and beliefs.

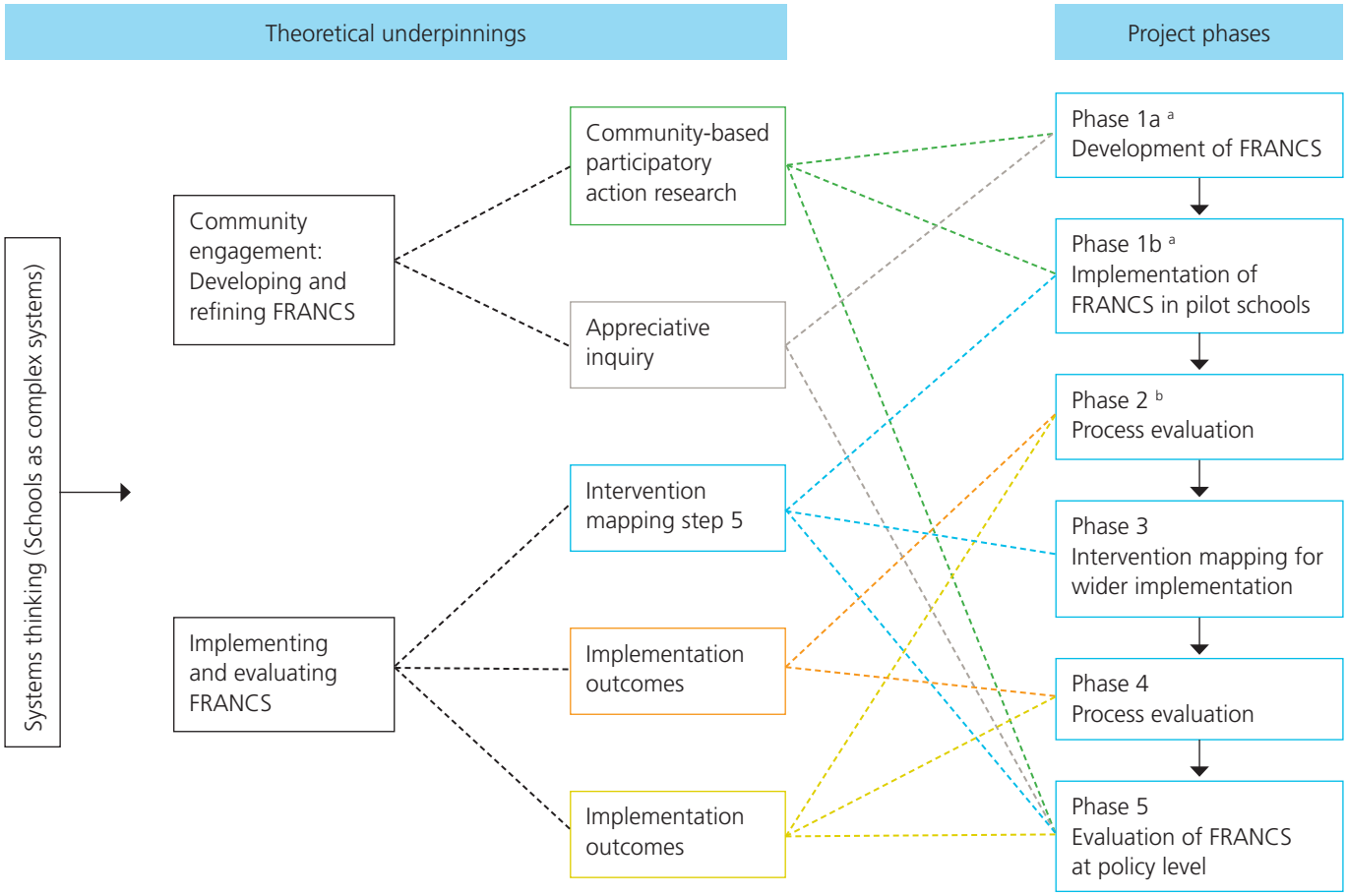
Engaging the community: Community-based Participatory Action Research and Appreciative Inquiry

In 2021, we used a qualitative Community-based Participatory Action Research (CBPAR) approach and Appreciative Inquiry to co-design FRANCS (Phase 1a). CBPAR supports a consensus-based approach to develop context-sensitive initiatives at a community level (Savin-Baden & Major, 2013). CBPAR entails a multidisciplinary partnership with communities, draws on several sources of knowledge, and is mutually beneficial (Schinke & Blodgett, 2016). We selected the CBPAR approach as the end-users of FRANCS are best situated to provide understanding of their school's context and to identify their own needs and preferences (Smith-Forbes et al., 2016). We invited community stakeholders to reflect actively on the challenges they experienced managing concussion in the school environment, instead of us, the researchers (as outsiders to these challenges), simply recommending solutions (Smith & Sparkes, 2016).

Appreciative Inquiry is a strengths-based approach that builds on positive experiences, ideally leading to lasting system changes. Organisations are invited to focus on what is working and on resources that are available to them, ensuring positive practices become standard across the organisation (Savin-Baden & Major, 2013). Appreciative Inquiry enabled us to move our thinking beyond trying to "fix the system", to focusing on identifying

Figure 1

Theoretical Underpinnings and Methodological Approaches Used to Co-design, Implement and Evaluate the FRANCS Framework in Schools and the Wider Community



Note. FRANCS = FRAmework for maNaging Concussions in New Zealand Secondary Schools.

[a] Phase completed. [b] Phase currently underway.

opportunities and possibilities that highlight and "supercharge" successful outcomes (Richer et al., 2010).

The Appreciative Inquiry process follows an iterative cycle. In the first phase, stakeholders are encouraged to explore the values of their organisation that allows it to function at its best. They reflect on positive past experiences and consider how these can be used to meet the goals of the project. In the next phase, stakeholders develop a goal-oriented plan that uses existing resources and strengths, and that can be sustained and maintained over the longer term. In the final phase, these desired changes or plans are put into practice and subsequently evaluated (Richer et al., 2010; Savin-Baden & Major, 2013).

Implementation and evaluation within a complex system

Intervention Mapping

Planning the implementation of FRANCS (Phase 1b, undertaken in 2022) was informed by Step 5 of the Intervention Mapping planning protocol (Donaldson et al., 2017). Intervention Mapping is a framework for theory- and evidence-based health promotion programme planning, consisting of six steps (Bartholomew et al., 2006). Intervention Mapping Step 5 can be used independently from the other steps to plan, adopt, implement, and maintain an intervention. During this step, we identified key adopters and implementers, and included representatives from end-users in the planning groups (Bartholomew et al., 2006).

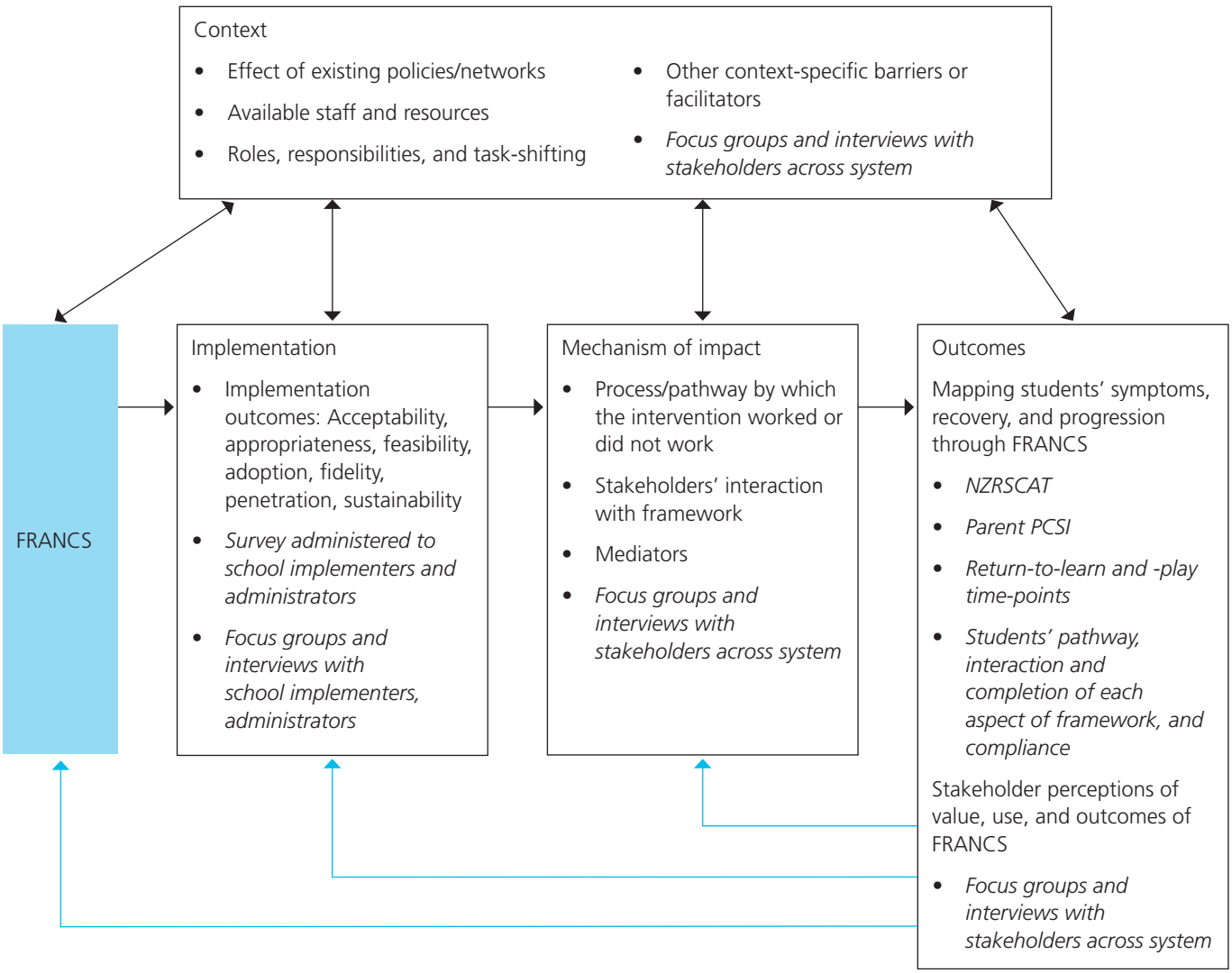
Implementation outcomes

We evaluated the successes and challenges of the implementation process during Phases 2 and 3 (Proctor et al., 2011). Implementation outcomes included:

1. Acceptability: Satisfaction with the framework, content, complexity, comfort, delivery, and credibility.
2. Appropriateness and feasibility: Perceived fit and actual fit, relevance, compatibility, suitability, usefulness, and cultural responsiveness.
3. Adoption: Uptake, utilisation, initial implementation, and intention.
4. Fidelity: Degree of intended FRANCS implementation, and quality of program delivery.

Figure 2

Process Evaluation (Phases 2 and 4)



Note. FRANCS = FRAmework for maNaging Concussions in New Zealand Secondary Schools. NZRSCAT = New Zealand Rugby Sport Concussion Assessment Tool; PCSI= Post-Concussion Symptom Inventory. *Italics* indicate the method of data collection employed as part of each construct.

5. Penetration: Integration within school system, and degree of adoption across schools.
6. Sustainability: Extent to which FRANCS is maintained or institutionalised.

Realist process evaluation

Effective intervention design should be informed by investigating underlying programme mechanisms (Moore et al., 2015). The aim of the evaluation is to understand how FRANCS "works" within specific contexts (different school environments with different resource capabilities), and what conditions may facilitate successful outcomes (Jagosh et al., 2012). Such evaluations provide insight into how findings might be transferred to other schools and settings in future (Moore et al., 2015).

As schools are complex adaptive systems, we expected that outcomes of FRANCS would not conform to strictly linear processes. We thus took a realist process evaluation approach to accommodate complexity. The realist process evaluation approach facilitates understanding of (a) the underlying mechanisms by which FRANCS operates (Pawson et al., 2005), and (b) how those mechanisms influence the outcomes of students with concussion progressing through that framework. Viewed from this perspective, the same intervention may have different outcomes at individual schools, depending on their contextual factors as well as the initial conditions within the systems (Prashanth et al., 2014). Contextual factors included geographical placement, rurality, resources available within the schools, staffing, and socio-economic and -cultural factors related to the school and its wider community.

Considering both system thinking and realist process evaluation principles, our research design was flexible so we could investigate unanticipated outcomes and identify potential patterns (Figure 2). An iterative process of inquiry and analysis was necessary to fully understand the implementation context, the mechanism by which FRANCs operates, and the outcomes for students who had sustained a concussion following the implementation of FRANCs in schools (Prashanth et al., 2014).

PHASES OF THE PROJECT PROTOCOL

Phase 1 – Development of FRANCS

Data collection

The University of Otago Human (Health) Ethics committee approved the study, and all participants signed written informed consent. In 2021, we undertook focus groups and semi-structured interviews with stakeholders from six schools to explore how concussions are currently managed, what factors facilitated their concussion management, and the key ingredients that constituted a "best practice" process. The six schools that agreed to participate had been part of the New Zealand Rugby Community Management Pathway initiative in Auckland and Otago in 2018–2019. These schools were purposely selected to include a range of socio-economic, gender, and ethnic distributions. Stakeholders included students with a concussion, and their parents/kaitiaki, teachers, school administrators and leaders (sports program coordinators/directors, heads of school), and health-care providers (nurses, physiotherapists, medical doctors). Key school contacts were asked to forward project information to students who had experienced a concussion and their parents/kaitiaki. The details of those who agreed to participate were forwarded to the research team. The perspectives of those stakeholders were used to co-develop a context-sensitive, adaptable framework, and ultimately provide clear, useable guidelines for schools.

Analysis

We used framework analysis (Gale et al., 2013) to develop a composite concussion management framework, informed by the participants' perceptions and proposed "action plans" of how concussion management could be operationalised in their schools. We used an iterative process, presenting the preliminary framework to participants and stakeholders at an interactive meeting, and revising the draft based on consensus. We then held focus groups with education and community partners and healthcare providers associated with the six schools (GPs, physiotherapists) to incorporate their input for the framework, and to provide insights regarding evidence-based "best practices" to further refine FRANCS. This phase was supported by content advisory groups, consisting of representatives from School Sport New Zealand (an organisation that coordinates, promotes, and protects secondary school sport), New Zealand School Nurses (a professional group connecting school nurses across Aotearoa New Zealand), New Zealand College of General Practitioners, and the New Zealand School Principals' Federation. We consulted with representatives from those groups via Zoom meetings while developing the project protocol and preparing grant applications. At the end of Phase 1a, we met with them again, presenting the first version of FRANCS (to be implemented in Phase 1b), and seeking their feedback.

Phase 1b – Implementation

The six schools involved in Phase 1a were invited to participate in Phase 1b, namely, the implementation of FRANCS. One of the four Otago-based schools declined to participate due to the complexity of the post-COVID environment. The two Phase 1a Auckland-based schools were also not available to participate in Phase 1b due to the lingering post-COVID impacts. We thus approached two schools in Hawke's Bay with information about the project, who agreed to participate. Five schools, three in Dunedin and two in Hawke's Bay, participated in Phase 1b.

Members of the research team worked with representatives of those five schools early in the 2022 school year to explain and field questions regarding FRANCS, guided by Intervention Mapping Step 5. Particular attention was given to the Hawke's Bay schools as they had not participated in Phase 1a, unlike the Dunedin-based schools. Prior to the implementation of FRANCS, we asked the representatives of the respective schools to identify their key stakeholders who would support the project. We then held meetings with those key school stakeholders to discuss the necessary implementation strategies, roles, and responsibilities of specific stakeholders (e.g., administrators, school nurses, deans, and individual teachers) and how FRANCS could be adapted to each school's local context. Field notes of the implementation process were collected by research assistants.

Phase 2 – Process evaluation

Quantitative data

Students who sustained a concussion were recruited via each school's representative. The representatives were asked to provide the participant information sheet to the student. If the student agreed, their contact details were provided to the assistant research fellow (ARF) working with the specific school. The ARF met with the student, provided more detailed information about the study, and gained written informed consent. For students younger than 16 years old, their parents/kaitiaki were contacted to provide consent. Throughout 2022, the ARFs collected data from students who sustained a concussion and their parents/kaitiaki on a weekly basis. Such data included return to learn and activity time-points, mapping of students' healthcare touchpoints, and completion/compliance of each aspect of the framework. During the weekly meetings, the ARF also assessed their concussion-related symptoms with the Symptom Score of the Child Sport Concussion Assessment Tool (SCAT5, Gavin et al., 2017), which is also included in the New Zealand Rugby Sport Concussion Assessment Tool (Salmon, Chua et al., 2022). Data were captured via the electronic data capture tool, Research Electronic Data Capture (REDCap), hosted at the University of Otago. Once the student reported having recovered, their kaitiaki were asked to complete the Parent Post-Concussion Symptom Inventory (Sady et al., 2014) via REDCap. We included all students with a suspected or confirmed concussion in the study who were referred by the school representative. Every effort was made to include all Māori and Pasifika students and kaitiaki who progressed through FRANCS in the evaluation. To ensure their voices and experiences are reflected in the development of FRANCS, their data was analysed as sub-units, wherever that was possible without compromising anonymity.

Towards the end of the school year, an online Likert-style questionnaire was administered via REDCap to school staff involved in the implementation of FRANCS to capture their satisfaction with FRANCS, and the implementation process (Proctor et al., 2011).

Descriptive demographic details were captured for the implementation (survey) and student outcomes (questionnaires, time-points, interactions with FRANCS). Appropriate bivariate analyses investigated potential relationships between demographic, survey outcomes, and various student outcomes.

Qualitative data

At the completion of Phase 2, we conducted focus groups and semi-structured interviews to cover the stakeholders' experiences with the implementation of FRANCS, and their perceptions of its value, utility, and outcomes for concussion management in their school. Participants included students and parents/kaitiaki with lived experiences of concussion as managed through FRANCS, and relevant sports directors, coaches, sports managers, teachers, and healthcare professionals.

We analysed transcribed data from the focus groups and interviews using a framework analysis method (Gale et al., 2013). We conducted cross-school analysis to iteratively identify patterns and differences across the different schools included in the study. All research team members reviewed and discussed the final analysis until consensus was reached.

Phase 3 – Intervention mapping for wider implementation

In this phase FRANCS was revised and tailored based on Phase 2 results. We followed the Intervention Mapping Step 5 again to plan implementation of the revised framework in the five schools that formed part of Phase 1b, as well seven additional schools to test the transferability of FRANCS. We approached potential schools to participate in Phase 3 using the same methods used for the two Hawke's Bay schools participating in Phase 1b. The seven schools that agreed included two in the wider Dunedin metropolitan area, three in North Otago, one in Hawke's Bay, and one in Auckland. In total, 12 schools participated in Phases 3 and 4.

Phase 4 – Second round process evaluation

We used the same process followed in phase 2 to evaluate the implementation of FRANCS in the additional seven schools recruited in phase 3 in 2023, and again in the five schools from Phase 2.

Phase 5 – Evaluation of FRANCS at policy level

Data collection

To be successful from a systems thinking perspective, implementation must be endorsed by key national governing organisations (Hulme & Finch, 2015). Concurrently to Phases 2 and 3, we sought insights and endorsement from relevant healthcare professional bodies, national sports organisations, and education stakeholders in different geographic areas. We undertook a snowball sampling approach by networking with these stakeholders, inviting them to recommend other organisations they believed relevant to the nationwide implementation of FRANCS.

Focus groups and semi-structured interviews in Phase 5 covered the stakeholders' perceptions of the value of FRANCS for their organisation or professional sector, recommendations to improve the framework, and for preparation of a national implementation of FRANCS. We transcribed interviews and focus group recordings, and analysed transcriptions using a framework analysis method (Gale et al., 2013), as described in Phase 2.

The findings of Phase 4 (process evaluation within the schools) will be merged with those of Phase 5 (evaluation by policy stakeholders) to inform the final FRANCS from this project. Input from those stakeholders, as well as from the advisory groups, will inform our plans for implementation beyond the 12 schools that participated in this project. Ongoing collaboration with all stakeholders will provide impetus for schools to embed FRANCS into their daily school practices to ensure student welfare, and into governance polices.

DISCUSSION

Early, evidence-informed best practice care is crucial for optimum recovery following concussion (Kontos et al., 2020). Although the Ministry of Education provides web-based information about concussion (Te Tāhuhu o te Mātauranga – Ministry of Education, 2019), there appears to be little awareness of these guidelines, and minimal implementation in schools. Several authors have emphasised the need for research to guide implementation of academic support or return-to-learn strategies for youth with concussion (Anderson et al., 2021; Gioia et al., 2016; Sarmiento et al., 2023). The aim of our project is to develop such guidelines through FRANCS, ensuring they have the flexibility to be adapted to each school's local context. The implementation and evaluation of FRANCS is using a staged approach with the goal to develop an adaptable guideline that could form the basis for regional, and, eventually, national roll-out.

In Canada, implementing concussion policies in high schools has contributed to general improved concussion awareness and concussion identification (Macartney et al., 2019; Matveev et al., 2018). Similarly, in the USA, online interventions such as "Brain 101: The concussion playbook" led to improved concussion knowledge of students, parents, and school staff (Glang et al., 2015). Students in schools who had implemented Brain 101 as an educational resource for concussion received more varied, individualised academic accommodations than students in control schools, and school, athlete, and parent knowledge improved for effective concussion management practices (Glang et al., 2015).

Based on the Canadian (Damji & Babul, 2018; Macartney et al., 2019; Matveev et al., 2018) and USA (Glang et al., 2015) experiences, adoption of FRANCS in Aotearoa New Zealand schools is likely to improve teacher and school awareness of concussions, in-class management, and provision of individual-specific academic accommodations (Mallory et al., 2022). FRANCS will provide clarity around recommended return-to-learn protocols, reassurance for parents and the student, and a flexible template to support stakeholder roles and responsibilities in the management of concussions. The framework may assist

the schools to meet their health and safety requirements and to develop context-specific concussion policies and procedures.

An important consideration for FRANCS is the inclusion of Māori and Pasifika knowledge, values, and practices to inform and improve students, parents/kaitiaki, and schools' awareness and accessibility to resources/care for concussions. In the New Zealand Rugby Concussion Management Pathway initiative, awareness of concussion guidelines and access to care were found to be a particular challenge for Māori or Pasifika players (Salmon et al., 2021). Lower awareness is likely to influence access to healthcare, and thus outcomes (Forrest et al., 2018; Gottgtroy et al., 2022).

We will continue to build collaborations and partnerships with Māori or Pasifika stakeholders to develop suitable resources, and with organisations that may already provide similar resources. A further critical feature of FRANCS is that it will apply to all students who have sustained a concussion, whether that was incurred during sports or non-sporting activities (Mallory et al., 2022). That is particularly relevant for the Aotearoa New Zealand context as less than 50% of concussion claims of the age group ≤ 19 years submitted to and accepted by ACC were sports-related (Accident Compensation Corporation, 2022).

The introduction of national or school concussion policies in other countries has enhanced stakeholder knowledge thereof, and of implementation of academic accommodations (Macartney et al., 2019; Mallory et al., 2022). Yet it is still unknown whether implementing such policies and frameworks lead to improved recovery time, and decreased risk of persistent symptoms and disability. Besides considering the sustainability and maintenance of FRANCS, its effectiveness for improving concussion outcomes of adolescent students would need to be established.

The FRANCS project is a multi-centred collaboration between New Zealand Rugby, Auckland University of Technology and the University of Otago. Our research team includes existing collaborations between New Zealand School Nurses, New Zealand College of General Practitioners, and the secondary schools involved in FRANCS. It includes input from health-care providers and their organisations, such as Physiotherapy New Zealand, and health-care providers contributing to Aotearoa New Zealand concussion services, thereby extending beyond sport-related concussion. We plan to extend these collaborations by working with those responsible for policy development and implementation within their sectors, seeking common goals to improve health, and education outcomes for youth who sustain concussion.

We bring together the triad of research, education, and industry (sport and healthcare) engagement to co-design flexible and culturally responsive concussion processes and policy to enhance the welfare of all secondary school students. These stakeholder-informed guidelines may be the first step towards developing a national framework enabling the integration between schools, and healthcare professionals, and ultimately improve health outcomes for students across Aotearoa New Zealand. Establishing an endorsed national level policy may be a critical step to these guidelines gaining traction within schools.

CONCLUSION

This protocol describes the methodologies and processes to develop, implement, and evaluate a concussion management framework to support safe return-to-learn and -sport for all students, regardless of concussion aetiology. This initiative has the potential to improve student outcomes, and decrease the risk of long-term consequences of concussion. A cohesive approach to students' recovery has the potential to reduce direct healthcare time and costs, while providing a flexible guide that outlines roles and responsibilities within the school to support the management of concussions.

KEY POINTS

1. This protocol describes a systems thinking approach for designing and implementing interventions in complex environments, such as schools.
2. Post-concussion return-to-learn guidelines are not yet effectively applied in schools, despite being important to support students during their recovery.
3. We outline the development and implementation of a context-sensitive and stakeholder-informed framework for managing concussion in Aotearoa New Zealand secondary schools.
4. A unified approach for optimal concussion management across secondary schools in Aotearoa New Zealand has the potential to transform concussion management in schools for all students, regardless of aetiology.

DISCLOSURES

This study is funded by a Lottery Health Grant and two grants of the Otago into Science–Participatory Science Platform of the Ministry of Business, Innovation and Employment. There are no conflicts of interest that may be perceived to interfere or bias this study.

PERMISSIONS

This study was approved by the University of Otago Human (Health) Ethics Committee (reference number, H22/025).

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CONTRIBUTIONS OF AUTHORS

Conceptualisation and methodology, DS, MB, GS, SW, SK, PL and KM; writing – original draft preparation, GS and MB; writing – review and editing, GS, MB, DS, SW, PL, KM and SK; visualisation: MB; project administration, GS; funding acquisition, GS, DS, MB, SW, SK, PL and KM.

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