The Accuracy of Coding for Sports-related Concussion in New Zealand: An Observational Study

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ABSTRACT

The aim of this study was to assess the accuracy of the Accident Compensation Corporation codes in a cohort of patients with sports-related concussion. Of particular interest were the codes registered by physiotherapists who may suspect sports-related concussion but are not permitted to diagnose it. Coding accuracy was assessed through review of Accident Compensation Corporation data, clinical notes, and referral letters for a cohort of patients seen in a New Zealand-based sports concussion clinic. Of 296 patients with a clinical diagnosis of sports-related concussion, 51.7% had a concussion-related code. General practitioners coded for concussion in 67.3% of cases for whom they submitted the Accident Compensation Corporation code, District Health Board health professionals (hospitalists) in 47.6%, and physiotherapists in 8.7%. A non-concussion-related code was used by physiotherapists in 87.5% of cases despite them suspecting sports-related concussion as per the study criteria. Use of the Accident Compensation Corporation codes to determine incidence and cost may substantially underestimate the true burden of sports-related concussion. There appears to be an opportunity to improve the accuracy of this coding. Engaging with physiotherapists and improving the process through which health providers are able to update codes are potential strategies.

Poloai, L., Fulcher, M., & Reid, D. (2023). The accuracy of coding for sports-related concussion in New Zealand: An observational study. *New Zealand Journal of Physiotherapy*, *51*(2), 100–104. https://doi.org/10.15619/nzjp.v51i2.349

Key Words: Concussion, Sports, Physiotherapy

INTRODUCTION

Sports-related concussion (SRC) is an important health issue (Harmon et al., 2019; Manley et al., 2017). It is estimated that up to 20% of SRCs are missed in New Zealand (Theadom et al., 2014). A commonly reported reason for this is athletes under-reporting symptoms of a possible SRC to medical staff (Delaney et al., 2018; Fraas et al., 2014; Longworth et al., 2021; O'Connor et al., 2020). In other cases, patients may present for an assessment and a SRC is not identified by their health care provider. This may be due to the inherent complexity of some SRCs, the lack of an objective marker, and the presence of other distracting injuries (Kutcher & Giza, 2014; McCrory et al., 2017). Another possible factor contributing to an underappreciation of the burden of SRC is inaccuracy of the coding systems used to record concussion diagnoses.

In New Zealand, the coding system used to record injuries is administered by the Accident Compensation Corporation (ACC). The ACC is a national taxpayer funded scheme that provides no-fault compensation to those who have suffered personal injuries as a result of an accident (ACC, 2022a). To receive funding from ACC, one must present to an ACC registered health provider, most often the patient's GP, physiotherapist, or a local hospital emergency department. Following an initial assessment, a standardised reporting form, the ACC45, is completed for all general injury claims. This form details the patient's clinical diagnosis using an ACC read code which is selected from a large list provided by ACC (ACC, 2022b). If the health provider is unable to find a code that matches the diagnosis, they can give a written diagnosis and ACC will select the best-matched code for the injury described (ACC, 2022b). If an International Classification of Diseases (ICD) code is used, ACC will convert this to a read code (ACC, 2022b). The most widely used ACC read code for concussion is S60 but there are additional related codes. Data from the coding system allows ACC to quantify the burden of injury and may be used in research and policy development (ACC, 2021a, 2021b; ACC Analytics & Reporting, 2022).

The ACC's national guidelines state that the assessment and diagnosis of SRC can only be made by a medical doctor (ACC SportsSmart, 2017). Many physiotherapists in New Zealand operate as primary care sports medicine providers and are frequently present at sports events. It has been shown in a New Zealand-based study that physiotherapists appear to have good knowledge, beliefs, and attitudes regarding SRC (Reid et al., 2020). It is possible that a proportion of patients with SRC initially present to a physiotherapist, and because the physiotherapist is not permitted to diagnose concussion, they register an alternate ACC code even if there is a high suspicion of SRC. This may result in inaccuracy of the ACC coding for SRC and an underappreciation of the SRC burden in New Zealand.

As ACC is capable of policy and strategy development, including injury prevention and management strategies, it is

important to be aware of limitations of the coding system and make improvements where possible (ACC, 2021a, 2021b). An accurate understanding of the true extent of the problem is also needed to measure the effect of any policy and strategic changes (Van Mechelen et al., 1992).

The purpose of this study was to assess the accuracy of the ACC codes in a cohort of patients with a clinical diagnosis of SRC, as defined by the existing ACC guidelines. To our knowledge no prior study has explored this. Of particular interest was the ACC codes used by physiotherapists. The intended contribution of this study was to, depending on the findings, highlight aspects of the SRC coding process that could be improved to enable greater understanding of the true burden of SRC and help to better inform future prevention and management strategies.

METHODS

The Axis Sports Medicine Sports Concussion Clinic based in Auckland, New Zealand, has been running since 2017. The clinic incorporates a multi-disciplinary approach and aims to offer an early assessment and diagnosis to optimise the management of SRC. Patients can self-refer to the clinic, but are frequently referred by their GP, physiotherapist, or District Health Board health professional, usually an emergency department doctor. A prospective data set has been collected since the clinic commenced and has been used to answer a range of different clinical questions.

A database was reviewed of 312 consecutive patients seen in the Axis Sports Medicine Sports Concussion Clinic between 2017 and 2018, with a clinical diagnosis of concussion. All patients, irrespective of whether a diagnosis of SRC had already been made by the referring health provider, had been assessed using a standardised protocol in line with the 2017 Concussion in Sports Group Statement, thought to reflect the state of knowledge of SRC at the time (Kara et al., 2020; McCrory et al., 2017). This assessment occurred during the initial consultation at Axis and first involved taking a history to review the mechanism of injury, details of any previous SRC, and concussion modifiers such as history of a migraine or mental health disorder (Kara et al., 2020). Examination consisted of completion of an age-appropriate Sports Concussion Assessment Tool 5 (SCAT5), additional neurological assessment of the cranial nerve and peripheral nerves, vestibular and cervical spine examination, and a review of supine and standing blood pressure for autonomic dysfunction (Kara et al., 2020). In all cases the assessing doctor had been a sports medicine specialist at Axis who had either made or confirmed the clinical diagnosis of concussion and was involved in subsequent management. A total of 16 patients were excluded as the concussion was not sustained during sporting activity. The data from ACC was then reviewed on all 296 patients, which included date of birth, gender, ethnicity, sporting activity, and the ACC code related to the injury. The health provider type that submitted the ACC code was also reviewed. This did not always match the health provider referring to the clinic and some patients had self-referred. Where needed, missing data points were acquired through manual review of standardised clinic notes, referral letters, and by searching the ACC coding database, after which the data for all patients were complete.

A manual review of clinical notes was then completed for all patients whose injury was coded by a physiotherapist. The intended methods for this descriptive analysis were developed by the study authors and agreed upon by physiotherapists who refer to the clinic. Any referral letters that had been sent by physiotherapists for these patients were reviewed for use of the terms "concussion", "SCAT", or "head injury". Use of any of these terms was taken to mean that a diagnosis of concussion was suspected. In cases where there was no referral letter, the referring physiotherapist was phoned once and emailed once and asked to review their own clinical notes for these terms. The purpose of this component of the study was to identify the proportion of physiotherapists who suspected a diagnosis of SRC but registered a non-concussion-related code. Cases were excluded where the source of referral to the clinic was unknown or not from a physiotherapist, or where there was no referral letter and no response from an email or phone call.

Ethics approval for this study was obtained via the Accident Compensation Corporation Research Ethics Committee (2019) as part of a larger, existing project.

RESULTS

Complete characteristics of the 296 patients included in the study are outlined in Table 1. The median age of patients in this study was 18.6 years and the majority (80.4%) were male. A total of 53.7% identified as European, 26.0% Pacific, 11.1% Māori, 4.7% Asian, and 4.4% were classified as "other", which was not further specified. SRC was sustained across 36 unique sporting activities with rugby union responsible for 50.7% of all injuries. The ACC code was submitted by GPs in 55.7% of cases, physiotherapists in 23.3%, a District Health Board health professional (not further specified) in 14.2%, and a sports medicine specialist in 4.1%.

A descriptive summary of the specific codes used is outlined in Table 2. Just over half (51.7%) the patients had an ACC code related to SRC. GPs coded for concussion in 67.3% of cases for whom they submitted an ACC code, District Health Board health professionals in 47.6%, and physiotherapists in 8.7%. The most common non-concussion-related codes used were neck sprain (S570), head injury (S646), and contusion of face, scalp, and neck excluding eye(s) (SE0). These codes collectively accounted for 61.5% of the non-concussion-related codes used.

In the physiotherapy sub-analysis there was a total of 48 cases referred to the service by a physiotherapist in which we could access a relevant referral or information about the physiotherapist's working diagnosis. A non-concussion-related code was registered with ACC by the physiotherapist in 42 of these 48 cases (87.5%), despite the physiotherapist suspecting SRC as per the study criteria. This accounted for 29.4% of all non-concussion-related codes registered in the study population. In 40 out of 42 (95.2%) cases the term used in the clinical notes was "concussion". In four cases the S60 concussion code was stated on the physiotherapy referral letter but a non-concussion-related code was registered.

DISCUSSION

The results of the current study suggest that ACC data on the claims and costs related to SRC may reflect only half the

Table 1

Patient Characteristics

Characteristic	*n* [a]	%
Age (*Mdn,* range)	18.6 (8.0–71.6)	
Sex		
Male	238	80.4
Female	58	19.6
Ethnicity		
European	159	53.7
Pacific	77	26.0
Māori	33	11.1
Asian	13	4.4
Other [b]	14	4.7
Sport		
Rugby union	150	50.7
Rugby league	43	14.5
Soccer	38	12.8
Field hockey	8	2.7
Cycling	7	2.4
Netball	5	1.7
Other [c]	45	15.2
ACC code provider		
General practitioner	165	55.7
Physiotherapist	69	23.3
District health board	42	14.2
Sports medicine specialist	12	4.1
Other [d]	8	2.7

Note. ACC = Accident Compensation Corporation.

[a] Unless indicated otherwise. [b] Not specified. [c] 30 sports, all less than five cases. [d] Nurse, chiropractor.

Table 2

ACC Coding

Variable	*n*	%
Concussion code used		
Yes	153	51.7
No	143	48.3
Non-concussion codes		
Neck sprain	37	12.5
Head injury	30	10.1
Contusion of face, scalp, and neck, excluding eye(s)	21	7.1
Intracranial injury not otherwise specified, no open intracranial wound, no loss of consciousness	9	3.0
Contusion, forehead	7	2.4
Other [a]	39	13.2
Concussion code used by provider type		
General practitioner	111	67.3
Physiotherapist	6	8.7
District health board	20	47.6
Sports medicine specialist	12	100.0
Other	4	50.0

Note. The head injury code does not count towards concussion statistics as per personal correspondence with the Accident Compensation Corporation (ACC).

[a] 29 codes, all less than five cases.

injuries that have actually been sustained, even though many of these injuries have received ACC funded treatment (ACC Analytics & Reporting, 2022). This will likely be compounded by the previously identified issues relating to under-reporting by both patients and clinicians. We cannot reliably measure the effectiveness of strategies to prevent and better manage SRC if our understanding of the true burden of SRC on the health system is inaccurate (Van Mechelen et al., 1992). This has clinical, social, and economic significance given that a proportion of these patients will experience lingering symptoms that could impact their ability to return to school, work, and sport (Manley et al., 2017; Theadom et al., 2018).

One area where a specific focus is needed relates to physiotherapists and the ACC codes for SRC. Given that many physiotherapists have identified a potential SRC, but have registered a non-concussion-related code, there may be opportunities to better engage with this group to improve coding accuracy. One possible solution would be to encourage physiotherapists to use a "suspected concussion" code that could then be confirmed by a medical doctor. Such a code would first need to be created by ACC. This could then be followed by education of physiotherapists that this is an option, for example, through updating the ACC national guidelines for SRC. There are data suggesting that physiotherapists who have good engagement with SRC in New Zealand have an excellent understanding of SRC. The majority (98%) in one cohort correctly identified symptoms of SRC and 99–100% correctly recognised who would possibly present with SRC in short scenarios in a questionnaire (Reid et al., 2020). Furthermore, physiotherapists are frequently in attendance at sporting events, commonly work with sporting teams, and are often involved in the treatment of patients seeking care for symptoms of SRC (Maxtone et al., 2020; Reid et al., 2020). Whether they are able to distinguish between patients who present with symptoms due to concussion and those who have a more significant brain injury is not known but the patient could be referred to a medical doctor to confirm the diagnosis as per the current ACC guidelines (ACC SportsSmart, 2017). Improving the coding process for physiotherapists in relation to SRC may increase the accuracy of the ACC codes by almost a third as per the findings in our study.

Another approach to improving the coding accuracy may be to focus on updating ACC codes, particularly when a diagnosis is confirmed by a specialist. In our study the sports medicine specialist submitted an ACC code in only 4.1% of cases. Given the percentages of GPs and District Health Board health professionals who used non-concussion-related codes, the sports medicine specialist likely made the clinical diagnosis

of SRC in a significant proportion of cases but the ACC code was not added. We are not aware of any study assessing how often health providers update an ACC code. ACC state that adding or changing a code can be done in a variety of ways such as through a built-in change code option in some practice management systems, the ACC18 medical certificate and via the ACC32 approval for prior treatment form (ACC, 2022c). The updated code must include a description to support this change and clinical records may be required (ACC, 2022c). There is no statement on the relevant ACC page regarding standard processing times. Anecdotally, the time taken for an ACC code to be added can be weeks. It may also be possible that some health providers are not up to date on the different ways that a code can be added. In raising awareness of the inaccuracy of the codes for SRC, we emphasise the importance to health providers of reviewing the ACC code for the patients they are seeing with SRC and changing the code when inaccurate or when a suspected case is medically confirmed. Improving the process through which health providers are able to add codes, perhaps through introducing a dedicated form just for this purpose, and providing education on the various options, may yield further benefit in improving SRC coding accuracy.

Finally, we recognise that the reliability of diagnostic coding in general can be affected by errors during the administrative process (Lucyk et al., 2017). In the current study we are unable to quantify the proportion of health professionals who submitted a written diagnosis that was subsequently allocated a code by ACC. Previous research has highlighted that the quality of a health professional's documentation can affect subsequent coding by administrative staff, and that there can also be variability in interpretation (Lucyk et al., 2017). There has been previous commentary on the difficulty these factors create in establishing the health and economic burden of SRC in Australia (Thomas et al., 2020). These factors may be affecting the accuracy of SRC coding in New Zealand.

This study has several limitations. First, the selection of consecutive patients from a single clinic increases the risk of sampling bias and so the clinic population may not be representative of the general population with SRC in New Zealand. Second, the data are several years old and so the trends described may have subsequently changed. We note, however, that at the time this article was published, the ACC SRC guidelines remain the same and there have been no major changes to the ACC coding system. Third, selection of the term concussion for the sub-analysis of physiotherapy referral letters may have introduced bias in that the referral letter was to a concussion clinic and thus there was potentially a degree of suspicion in the majority of cases. Finally, the study is descriptive only and so, while physiotherapists appear to regularly use non-concussion-related codes despite suspecting SRC, there are no inferential statistics to support this at this stage.

CONCLUSION

The current study suggests that only half of patients with a clinical diagnosis of SRC have a concussion-related ACC code. As a result, use of the ACC codes to determine incidence and cost may substantially underestimate the true burden of SRC. We cannot reliably measure the effectiveness of strategies to prevent and better manage SRC if our understanding of the true burden of SRC on the health system is inaccurate. There appears to be an opportunity to create better processes to help clinicians improve the accuracy of this coding. Engaging with physiotherapists and improving the process relating to viewing and changing coded diagnoses are potential strategies.

KEY POINTS

1. Use of the ACC codes to determine incidence and cost may substantially underestimate the true burden of SRC. Many physiotherapists used a non-concussion-related code despite suspecting SRC, likely due to the current SRC guidelines.
2. One possible solution to improve coding would be to introduce the option of a "suspected concussion" code for physiotherapists to use, which could then be confirmed by a medical doctor.
3. Improving the process through which health providers are able to update codes and providing education on the various options to do so may also yield benefit in improving coding accuracy.

DISCLOSURES

No funding was obtained for the study. There are no conflicts of interest.

PERMISSIONS

Ethics approval for this study was obtained via the Accident Compensation Corporation Research Ethics Committee as part of a larger, existing project. All patients included in the study consented to the potential use of the clinical notes for future research.

CONTRIBUTIONS OF AUTHORS

MF initiated the research, secured ethics approval, and led the data collection supported by LP. LP analysed the data and drafted the paper with review and editing by MF and DR. LP was responsible for the final version and responding to peer review and editorial committee comment.

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