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Soccer (Football) Injuries in New Zealand: A Review of Ten Years (2010-2020) of Accident Compensation Corporation Entitlement Claims and Costs

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Introduction

Participation in football (hereinafter termed soccer) has been reported [1] to induce considerable health risk factor benefits in terms of cardiovascular and neuromuscular fitness across the age spectrum. Although soccer has the potential to support a healthy lifestyle, it is a high-intensity sport with frequent changes of movement, velocity and direction combined with direct physical contact and high impacts that all pose an injury risk [2].

Sports-related injuries have been reported to account for the loss of approximately 40% of the health benefits obtained from participation in soccer [3]. A consequence of these injuries are long periods of absence from sport and work as well as recurrences of these injuries if not appropriately managed [3]. In addition, secondary injuries (e.g., development of osteoarthritis) can occur long term, reduced quality of life, loss

Abstract

Background: Sports-related injuries account for the loss of approximately 40% of health benefits obtained from participation in soccer.

Objectives: To provide for the first-time, epidemiological data and related costs for moderate-to-serious and serious injury claims for soccer (football) in New Zealand over a ten-year period.

Methods: Data obtained from Accident Compensation Corporation (ACC) were analysed by year of competition, age, ethnicity, gender, body region and injury type for total and Moderate-to-Severe (MSC) claims and costs.

Results: Over the 2010 to 2020 period a total of 429,681 injury entitlement claims were recorded costing \$420,593,764 (AU\$402,088,981). There was an increase in the number of injury entitlement claims ($t_{(10)}=31.43$; $p<0.0001$) and costs ($t_{(10)}=16.77$; $p<0.0001$) over ten years (total claims increased by average of 5.1%±6.8% per-year and total costs increased by average of 6.2%±4.5% per year). Lower limb injuries were most frequent (n=276,151; 64.3%) averaging 25,105±2,390 entitlement claims per year at a cost of \$23,769,876±\$4,251,193 (AU\$22,724,080±AU\$4,064,157) per year. Although fracture dislocations (36,150; 8.4%) and concussions (5,465; 1.3%) recorded less than 10% of total injuries they had the highest mean costs per-claim (fracture-dislocations \$1,889±\$212 [AU\$1806±AU\$203]; concussions \$977±\$540 [AU\$934±AU\$516]). Players over 35 years old recorded 23.1% of total injury entitlement claims and 35.2% (\$133,510,134 [AU\$126,727,178]) of total costs.

Conclusions: Despite injury prevention interventions by New Zealand Football and the ACC, soccer injuries continue to be frequent and costly – particularly lower limb injuries, fracture dislocations and concussions. Further injury prevention interventions targeted at specific age groups and injury causes are warranted.

Keywords: Football injuries; Injury costs; Ethnicity

of career opportunities, negative psychological effects and an increase in direct as well as indirect health-related costs can occur [3]. For example, it has been reported [4] that sport-related injuries accounted for (Euros) €168,000,000 (NZ\$294,669,967; US\$181,161,288) of direct accident-related costs but also €244,000,000 (NZ\$427,973,047; US\$263,115,204) of indirect costs representing the third-largest cost factor after household and traffic accidents.

Recently it was reported [5] that there were 45,000 soccer-related injuries recorded annually in Switzerland. The estimated costs for these injuries were approximately €153,000,000 (NZ\$268,360,149; US\$164,986,173) and this resulted in a mean cost of €3,400 (NZ\$5,963; US\$3,666) per soccer-related injury [5]. In a New Zealand based study [6], there were 14,240 soccer-related injuries over a five-yr. period (2012 to 2016). The reported [6] costs for soccer related injuries were NZ\$9,237,392 (US\$5,679,241) resulting in a mean cost per-injury-claim of NZ\$6,833 (95% CI: \$6,438 to \$7,315) (US\$4,200 [95% CI: US\$3,957 to US\$4,496]). This study [6] also reported on four other sporting codes in New Zealand and did identify soccer specific injuries but no study to date has been dedicated to a longitudinal overview of the number and related costs associated with soccer participation in New Zealand. Therefore, this study was undertaken to provide an epidemiological overview of the types of injuries and the related costs for soccer injuries in New Zealand over a ten-year period from 2010-2021.

Methods

The methods undertaken in this study are identical to previous studies [7,8] reporting on injuries recorded through the New Zealand national health provider, Accident Compensation Corporation (ACC). The ACC database was utilised to provide descriptive epidemiological data including the costs associated with treatment for injuries occurring in female rugby union activities. The ACC covers compensation for the injury (sporting or other) including medical treatment, income replacement, social and vocational rehabilitation, and ancillary services (transportation and accommodation) as part of the rehabilitation. Coverage is guaranteed by ACC, but this is offset by the restriction to sue for personal injury except in rare circumstances for exemplary damages [7]. ACC injury entitlement claims are categorised as minor (medical treatment only), moderate-to-serious [7] (MSC) or serious [9,10]. The terms are defined under the Injury Prevention, Rehabilitation and Compensation (IPRC) Act, 2001 with the ACC responsible for meeting the costs of these injuries [11]. Minor claims are lodged following an accident and generate a payment for the period reported to the registered licenced practitioner (e.g., physiotherapist, General Practitioner) for the medical treatment provided [11]. Typically, minor claims do not require loss of time from employment, where the claimant does not require additional medical support and involves a few treatments with the ACC meeting most of the costs [11]. Moderate-to-serious injury entitlement claims occur following an accident, generate a payment for the period reported and require additional financial support for treatment, loss of earnings and related medical costs [7,11]. Serious injury entitlement claims require a prolonged period of financial support, loss of earnings and related medical support and are monitored by the Serious Injury Claim Unit, typically over a long period of time [9,10]. Moderate-to-serious and serious injury entitlement claims account for approximately 8% of total claims recorded, but can account for 80% of total costs [7,11].

This study focused on moderate-to-serious and serious-injury entitlement claims that occurred from 1st January 2010 to 31st December 2020 resulting from participating in soccer activities. The data collected contains a combination of both futsal and soccer related injuries due to ACC coding.

The injury definition utilised for this study was “any injury (minor, moderate-to-serious and serious injury) that had been assessed and reported by a registered health practitioner as a result of sports participation” [12]. The injury also had to have been accepted as an ACC claim during the study period to be recorded in the study dataset. All costs were inflation adjusted using the Reserve Bank inflation adjustor (<https://www.rbnz.govt.nz/monetary-policy/inflation-calculator>) to reflect all costs at 2021 rates with a mean inflation of 10.9 ±5.0% per-year.

Data were obtained from the ACC through the Official Information Act and was reviewed by the ACC Ethics committee before being made available for release. Informed consent from the injured participants was not obtained as de-identified data were collected from the ACC database without individual participant identification or follow-up. All claims were classified by ACC and do not provide a measure of severity but give an indication of the impact on the person's life. The classifications were (a) entitlement claims (*claims that received an entitlements such as weekly compensation, vocational or social rehabilitation*); (b) Other benefit claims (*claims that did not receive any of the payments listed under entitlement claims above but did receive an independence allowance, lump sum or miscellaneous benefits/expenditure*); (c) Medical fees only claims (*claims that did not receive any of the payments listed under entitlement claims or other benefit claims above but did receive payments for medical treatment, dental treatment or conveyance for medical treatment*); and (d) No payment claims (*claims do not have any associated payments. These are usually claims that received only treatment at a public hospital during the acute phase of an injury*).

All data collected were entered into a Microsoft Excel spreadsheet and analysed with SPSS (IBM Corp, Released 2017. IBM SPSS Statistics for Windows, Version 25.0 Armonk, NY: IBM Corp). Data are reported as means and Standard Deviations (±SD). Comparisons of the number of claims and costs over the reporting years were calculated using an independent t-test. A one-sample chi-squared (χ^2) test was utilised for comparison between reporting years for the number of claims and costs recorded and between 2010 and 2020. These years were chosen as they were the start and the end of the study duration. Injury incidence was not calculated for the study as the sporting codes participation rates were not available as part of the data analysis. All costs are reported in NZ Dollars (\$) and United States Dollars (US\$) unless otherwise indicated.

Results

Over 2010 to 2020 a total of 429,681 injury entitlement claims were recorded costing \$420,593,764 (US\$239,048,293) (see Table 1). This resulted in an average of 39,062±4,122 total claims per-year costing an average of \$979±\$153 (US\$556±US\$83) per-claim per-year. The number of total claims increased by an average of 5.1% ±6.8% per-year whereas total costs increased by an average of 6.2%±4.5% per year. The injury entitlement claims accounted for 6.4% (n=26,798) of total number of claims but 70.0% (\$265,286,834 [AU\$253,615,060]) of total costs. There was an average of 2,436±433 entitlement claims per-year costing \$24,116,985±\$5,027,591 (US\$13,104,039±US\$2,731,757).

Table 1: Years of injury, claims type and ethnicity reported as total number, average per year, total costs, average costs per year and average cost per injury claim in New Zealand Dollars (\$) with 95% standard deviations for soccer by year from 2010 to 2020.

		Injury Claims		Injury Costs		
		Total	Average per year	Total costs	Average cost per year (NZD\$)	Mean cost per claim (NZD\$)
		n=(%)	Mean±SD	NZD\$(%)	Mean±SD	Mean±SD
Year	2010	33,742(7.9)	5,623.7±9,085.9	\$27,756,708 (6.6)	\$4,614,675±\$7,507,962	\$799±\$87
	2011	32,492 ^{ab} (7.6)	5,415.3±8,793.9	\$27,521,923 ^{ab} (6.5)	\$4,756,826±\$7,981,061	\$824±\$119
	2012	35,358 ^{ab} (8.2)	5,893.0±9,458.4	\$30,031,761 ^{ab} (7.1)	\$5,005,977±\$7,871,915	\$896±\$114
	2013	38,494 ^{ab} (9.0)	6,415.7±10,343.4	\$32,323,145 ^{ab} (7.7)	\$5,481,776±\$8,943,136	\$842±\$153
	2014	42,839 ^{ab} (10.0)	7,139.8±11,283.2	\$37,728,927 ^{ab} (9.0)	\$6,081,404±\$9,547,399	\$833±\$119
	2015	43,179 ^{ab} (10.0)	7,196.5±11,247.1	\$40,592,156 ^{ab} (9.7)	\$6,530,302±\$10,287,512	\$870±\$136
	2016	43,660 ^{ab} (10.2)	7,276.7±11,372.0	\$42,327,22 ^{ab6} (10.1)	\$6,931,761±\$10,352,171	\$955±\$214
	2017	40,873 ^{ab} (9.5)	6,812.2±10,426.7	\$44,030,785 ^{ab} (10.5)	\$6,751,526±\$10,248,969	\$962±\$214
	2018	40,345 ^{ab} (9.4)	6,724.2±10,189.6	\$45,136,545 ^{ab} (10.7)	\$6,444,787±\$9,953,584	\$921±\$97
	2019	43,022 ^{ab} (10.0)	7,170.3±10,853.9	\$47,585,325 ^{ab} (11.3)	\$6,788,204±\$9,936,911	\$987±\$134
2020	35,677 ^{ab} (8.3)	5,946.2±8,909.7	\$45,559,262 ^{ab} (10.8)	\$3,814,404±\$5,574,977	\$654±\$135	
Total		429,681 (100.0)	39,061.9±4,122.3	\$420,593,764 (100.0)	\$5,745,604±\$1,064,242	\$868±\$94
Claims	Entitlement	26,798	2,463.2±432.5	\$265,286,834 (70.0)	\$24,116,985±5,027,591	\$10,006±\$1,774
	Other Benefit	150	13.6±3.9	\$386,955 (0.1)	\$35,178±\$11,183	\$2,612±\$434
	Medical Fees	379,248	34,477.1±3,735.5	\$113,536,064 (29.9)	\$10,321,460±\$1,452,611	\$298±\$14
Ethnicity	Asian	44,069 (10.3)	4006.3 ±642.5	\$41,352,185 (9.8)	\$3,759,290±\$986,028	\$928±\$133
	European	298,776 (69.5)	27161.5±2643.5	\$262,008,475 (62.3)	\$23,818,952±\$4,112,436	\$873±\$96
	Māori	24,299 (5.7)	2209.0±273.4	\$17,085,028 (4.1)	\$1,553,184±\$354,493	\$698±\$101
	Pacific Peoples	18,673 (4.3)	1697.5±210.5	\$18,321,579 (4.4)	\$1,665,598±\$381,927	\$974±\$145
	Other Ethnicity	34,741 (8.1)	3158.3±440.0	\$33,349,022 (7.9)	\$3,031,729±\$812,697	\$951±\$167
	Unknown	9,123 (2.1)	829.4±114.1	\$7,093,565 (1.7)	\$644,870±\$122,553	\$783±\$131

SD: Standard Deviation; (%): Percentage; NZD: New Zealand Dollars; *: due to data rounding and confidentiality requirements, numbers do not add to total number of total injury claims and costs reported; significant difference (p<0.05) than (a) = difference from previous year; (b) = difference from 2010.

Table 2: Gender and age group reported as total number, average per year, total costs, average costs per year and average cost per injury claim in New Zealand Dollars (\$) with 95% standard deviations for soccer by year from 2010 to 2020.

		Injury Claims		Injury Costs		
		Total	Average per year	Total costs	Average cost per year (NZD\$)	Mean cost per claim (NZD\$)
		n=(%)	Mean±SD	NZD\$(%)	Mean±SD	Mean±SD
Gender	Female	87,106 ^a (20.3)	7,919±882	\$65,113,455 ^a (15.5)	\$5,919,405±\$1,180,509	\$743±\$87
	Male	342,575 ^b (79.7)	31,143±3,245	\$314,096,399 ^a (74.7)	\$28,554,218±\$5,257,550	\$912±\$100
Age Group	00-04	666 (0.2)	60.5±19.9	\$140,481 (0.0)	\$12,771±\$5,777	\$210±\$77
	9-May	21,375 (5.0)	1,943.2±330.7	\$5,114,548 (1.2)	\$464,959±\$102,443	\$238±\$19
	14-Oct	84,996 (19.8)	7,726.9±1,290.5	\$26,848,336 (6.4)	\$2,440,758±\$466,035	\$315±\$22
	15-19	88,896 (20.7)	8,081.5±936.2	\$49,838,594 (11.8)	\$4,530,781±\$727,841	\$559±\$53
	20-24	52,776 (12.3)	4,797.8±451.2	\$58,042,724 (13.8)	\$5,276,611±\$1,078,070	\$1,095±\$176
	25-29	46,297 (10.8)	4,208.8±408.6	\$57,935,170 (13.8)	\$5,266,834±\$1,176,062	\$1,242±\$189
	30-34	35,424 (8.2)	3,220.4±254.4	\$47,780,006 (11.4)	\$4,343,637±\$980,119	\$1,337±\$224
	35-39	29,657 (6.9)	2,696.1±117.1	\$40,977,658 (9.7)	\$3,725,242±\$647,289	\$1,383 ±\$252
	40-44	27,416 (6.4)	2,492.4±228.9	\$37,547,840 (8.9)	\$3,413,440±\$631,323	\$1,362±\$180
	45-49	21,431 (5.0)	1,948.3±155.9	\$27,441,474 (6.5)	\$2,494,679±\$464,398	\$1,275±\$178
	50-54	12,199 (2.8)	1,109.0±196.5	\$16,775,265 (4.0)	\$1,525,024±\$417,626	\$1,367±\$240
	55-59	4,999 (1.2)	454.5±152.6	\$6,924,849 (1.6)	\$629,532±\$322,386	\$1,429±\$701
	60-64	1,916 (0.4)	174.2±57.3	\$2,480,286 (0.6)	\$225,481±\$162,711	\$1,225±\$614
	65-69	875 (0.2)	79.5±32.2	\$919,710 (0.2)	\$83,610±\$50,729	\$1,061±\$517
	70-74	477 (0.1)	43.4±24.0	\$236,964 (0.1)	\$21,542±\$13,776	\$501±\$212
	75-79	184 (0.0)	16.7±11.4	\$148,757 (0.0)	\$13,523±\$13,702	\$866±\$739
80-84	57 (0.0)	5.2±4.5	\$18,254 (0.0)	\$1,825±\$2,067	\$339±\$422	
85+	45 (0.0)	4.1±0.3	\$37,680 (0.0)	\$3,425±\$6,009	\$849±\$1,505	
Unknown	24 (0.0)	2.2±2.1	\$1,395 (0.0)	\$279±\$236	\$70±\$59	

SD: Standard Deviation; (%): Percentage; NZD: New Zealand Dollars; *: due to data rounding and confidentiality requirements, numbers do not add to total number of total injury claims and costs reported; significant difference (p<0.05) than (a) = male; (b) = female

Although people reporting to be European accounted for more than half of the injury claims (70%; n=298,776) and costs (\$262,008,475 [US\$148,914,901]), people reporting to be Pacific Peoples (\$974±\$145 [US\$554±US\$82]), Other

Ethnicity (\$951±\$167 [US\$540±US\$95]) and Asian (\$928±\$133 [US\$527±US\$76]) had high mean costs per-claim per-year. There was an observable increase in the number of injury entitlement claims ($t_{(10)}=31.43$; $p<0.0001$) and associated costs ($t_{(10)}=16.77$;

Table 3: Injury region and injury type reported as total number, average per year, total costs, average costs per year and average cost per injury claim in New Zealand Dollars (\$) with 95% standard deviations for soccer by year from 2010 to 2020.

		Injury Claims		Injury Costs		
		Total	Average per year	Total costs	Average cost per year (NZD\$)	Mean cost per claim (NZD\$)
		n=(%)	Mean±SD	NZD\$(%)	Mean±SD	Mean±SD
Injury region	Head and Neck	37,379 (8.7)	3,398.1±466.5	\$21,647,807 (5.1)	\$1,967,982±\$587,794	\$569±\$107
	Upper Limb	66,153 (15.4)	6,013.9±723.2	\$63,746,802 (15.2)	\$5,795,164±\$1,129,076	\$959±\$114
	Lower Limb	276,151 (64.3)	25,104.6±2,389.5	\$261,468,641 (62.2)	\$23,769,876±\$4,251,193	\$942±\$105
	Other Injury Site	49,998 (11.6)	4,545.3±616.3	\$32,346,610 (7.7)	\$2,940,601±\$645,597	\$647±\$110
Injury type	Soft Tissue Injury	359,481 (83.7)	32,680.1±3,644.7	\$283,023,938 (67.3)	\$25,729,449±\$4,988,154	\$782±\$87
	Fracture/ Dislocation	36,150 (8.4)	3,286.4±276.9	\$68,523,055 (16.3)	\$6,229,369±\$968,738	\$1,889±\$212
	Laceration/ Wound	14,429 (3.4)	1,311.7±132.1	\$4,316,842 (1.0)	\$392,440±\$125,137	\$298±\$83
	Concussion/ Brain Injury	6,551 (1.5)	595.5±54.1	\$3,027,220 (0.7)	\$275,202±\$58,131	\$459±\$81
	Dental Injuries	5,465 (1.3)	496.8±149.2	\$5,984,889 (1.4)	\$544,081±\$435,711	\$977±\$540
	Other	7,605 (1.8)	691.4±164.3	\$14,333,918 (3.4)	\$1,303,083±\$407,685	\$1,949±\$703

SD: Standard Deviation; (%): Percentage; NZD: New Zealand Dollars; *: due to data rounding and confidentiality requirements, numbers do not add to total number of total injury claims and costs reported

$p < 0.0001$) over the duration of the recording period (see Table 1). There were more entitlement claims recorded in 2016 ($n=43,660$) than 2010 ($n=33,742$; $\chi^2_{(1)}=1270.89$; $p < 0.0001$) and 2017 ($n=40,873$; $\chi^2_{(1)}=91.89$; $p < 0.0001$). There were observable increases in total costs in 2019 (\$47,585,325 [US\$27,045,552]) when compared to 2010 (\$27,756,708 [US\$15,775,778]; $\chi^2_{(1)}=5218521.94$; $p < 0.0001$), 2018 (\$45,136,545 [US\$25,653,766]; $\chi^2_{(1)}=64672.16$; $p < 0.0001$) and 2020 (\$45,559,262 [US\$25,894,021]; $\chi^2_{(1)}=44070.53$; $p < 0.0001$).

Males recorded most of the injury entitlement claims (79.7%; $n=342,575$) and costs (82.8%; \$314,096,399 [US\$178,519,547]) (see Table 2). As a result, males recorded a higher mean cost per entitlement claim (\$912±\$100 [US\$518±US\$57]) compared with females (\$743±\$87 [US\$422±US\$49]; $t_{(10)}=4.90$; $p=0.0006$) The 15 to 19 year age group recorded a fifth ($n=88,896$ 20.7%) of total injuries but only 13.1% of total costs (\$49,838,549 [US\$28,326,192]).

Although the 20-to-24-year age group recorded the highest total costs (\$58,042,724 [US\$32,989,110]; 15.3%), the 55 to 59 year age group recorded the highest mean cost per claim (\$1,429 ±\$701 [US\$812 ±US\$398]). Players over the age of 40 years accounted for 16.2% of total injury claims ($n=69,623$) but 24.4% of total costs (\$92,532,476 [US\$52,591,675]) resulting in a mean cost of \$1,322 ±\$176 (US\$751 ±US\$100).

Although the lower limb recorded the most entitlement claims and costs ($n=276,151$; 64.3%) averaging 25,105 ±2,390 entitlement claims per year at a cost of \$23,769,876 ±\$4,251,193 (US\$13,509,825 ±US\$2,416,204) per year (see Table 3), the upper limb recorded the highest mean cost per claim (\$959 ±\$114 [US\$545 ±US\$65]).

Soft tissue injuries accounted for most entitlement claims ($n=359,481$; 83.7%) and recorded the highest mean costs per year (\$25,729,449 ±\$4,988,154 [US\$14,623,567 ±US\$2,835,063]). Although fracture dislocations ($n=36,150$; 8.4%) and dental injuries (5,465; 1.3%) recorded less than 10% of total injuries they did record the highest mean costs per claim (fracture-dislocations; \$1,889 ±\$212 [US\$1,073 ±US\$120]; dental injuries \$977 ±\$540 [US\$555 ±US\$307]).

Discussion

This is the first study to report on the number of ACC claims lodged, and the associated costs of sports-related injuries that occur in soccer over a 10-year period. The information on the injury claims and costs add to prior reports of ACC sports data for rugby league [12], and rugby union [6]. In addition, the numbers reported in this study are not a reflection of how many injuries were occurring [8] but how many injuries were recorded by the individual participants as a result of participating in soccer. Further, the results of this study exclude those soccer participants that did not lodge an ACC injury entitlement form for injuries dealt with by themselves. Consequently, there may be an under-reporting of the actual number and costs of these injuries. All the injuries recorded in this study required additional assistance beyond medical treatment alone [11].

It was not unexpected that males recorded more injuries than females as males represented the largest cohort of participants in soccer. Previous epidemiological studies reporting on the costs of sports related injuries [8,12] reported that there were more male than female MSC claims and costs. It was suggested [13] that this may be due to the differences in the physical intensities males participate in sport when compared with females who reportedly display reduced speed and agility, lower muscular power, lower estimated maximal aerobic power and a greater body mass and skinfold thickness than males. Previous studies [14,15] have reported that females participating in sports such as rugby union have increased risk factors, when compared with male participants such as smaller stature, weaker neck muscles [16], lower head/neck mass [14,15] and a greater acceleration of their head and neck with a lower ability to protect their heads from unanticipated impacts [17]. It has also been suggested [18] that females partake in sport in a less aggressive manner than males and this would result in a lower injury rate being reported. Despite this, it has been reported that females have similar attitudes to males in terms of sports participation in areas such as aggression, physical danger and injury [19]. When comparing the results of this study to previous studies [8,12], the differences in the MSC claims reported would be related to the lower number of females participating in the sport, not the lack of aggression, intent or will to win.

Although there have been studies reporting on the incidence of injuries as a result of soccer match and training participation, there is a paucity of these studies reporting on both New Zealand based and female soccer participants. This is concerning as there has been a reported [20] exponential growth in female participants playing soccer worldwide. Increasing numbers of people older than 35 years, train for, and compete in, team and individual sporting activities [21]. It is accepted [22] that exercise can assist with preventing, or reducing, age related changes in the structure and function of the body. Injuries to sports participants over 35 yr. can present a unique challenge to the sports medicine community with the injuries occurring alongside age-related changes and underlying pathologies [23]. The introduction of the masters' level competitions has enabled people to continue on within their sporting activities and this can be seen with injuries being recorded for people up to, and including over 85 years old. The finding of a large proportion of total injury entitlement claims and total costs for those over 35 years old was similar to previous studies [6,12]. Although there are increasing numbers of participants competing in older age level sport and there are regular sporting competitions, there is a paucity of studies detailing the incidence of injuries specifically to the master's participation level in soccer. Research into this participation age group is warranted to identify the risks and injury incidence that occurs.

The mean cost per concussion (\$459 [US\$261]) was substantially lower than previously reported [6] (\$3,239; [US\$1,840]). A possible reason may be related to the way in which the data were reported. The previous study [6] covered 2012 to 2016. However, the data obtained differentiated between minor and MSC claims enabling the identification of the different costs. Although the current data reported medical fees claims in the number of claims and total costs, it did not differentiate between the costs of medical fees only and the costs of those concussions that required additional support in recovery. In addition, the data did not differentiate between male and female participants recording a concussion. It has been reported that females have a 1.5 to 2.4 times greater incidence rate for concussions [15], suffer prolonged neuropsychological impairments [24], perform worse on neurocognitive tests post-concussion [25], have poorer outcomes, more post-concussion symptoms and a prolonged recovery [26] than male participants. Further research into soccer related concussion related injury entitlement claims and costs may help identify the extent of the difference between males and female soccer participants.

Although the majority of ACC claims (379,248; 88.3%) reflect the number of injuries that resolved without further medical assistance, the data recorded through ACC should not be reflective of total incidence of the injuries that occurred through participation in women's rugby union in New Zealand [8]. The results reported in this study exclude those participants that did not make an injury entitlement claim for more minor injuries [8]. Although the injuries recorded through the ACC database identify the sporting activity, it does not identify whether the injuries recorded were from participation in the sport, just that they occurred at a rugby union activity. Additionally, the terminology of 'moderate-to-serious' and 'serious' are not a reflection of the severity classification of the injury but are the accounting terms applied by ACC to the costs involved with the rehabilitation of the injury. The moderate-to-serious claims recorded in this study may not necessarily have been lodged or the accident have occurred, during the same period reported. Moderate-to-serious claims are recorded if there has been any

entitlement received during the life of the claim and they are backdated to the day the claim was lodged. If there were to be future entitlements, then the data reported here would change accordingly. As such, there was no indication as to whether the injury claims recorded were for new, recurrent or exacerbation of previous injuries within these sporting activities.

The New Zealand ACC have invested in injury prevention initiatives for football since the introduction of SportSmart in 1999 [27]. The current "Fit4Football" player welfare and prevention programme developed by New Zealand Football (Soccer) in partnership with ACC SportSmart supports footballers in enhancing their performance, injury prevention, and wellbeing. The programme includes FIFA's 11+ warm-up programme designed to reduce the risk of injury in football. Whilst the New Zealand Football website states "this programme has reduced the risk of all injury by 30%, and severe and debilitating injuries by 50%" and Al Attar's [28] meta-analysis of meta-analyses for studies that have used the FIFA 11+ reported an overall risk reduction of 34% (RR=0.66 [0.60-0.73]) for all injuries and a reduction in 29% (RR=0.71 [0.63-0.81]) for injuries to the lower limbs, these levels of injury reduction were not evident when looking at the ACC national injury statistics.

Conclusion

Despite injury prevention interventions by New Zealand Football and the ACC, soccer injuries continue to be frequent and costly – particularly lower limb injuries, fracture dislocations and concussions. The greatest number of soccer injuries reported occurred in the 10-to-19-year-old players, injury prevention initiatives need to be targeted at this age group. As players over 35 years old sustained more severe injuries as indicated by the proportion of total costs being disproportionate to the number of claims, this group also needs to be a focus for injury prevention initiatives. Further injury prevention interventions targeted at specific age groups and specific injury causes are warranted.

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29. Practical implications
30. Total costs and mean costs per-claim increased over the 10-year period. In addition, the percentage increase in costs (107.9%) was greater than the rate of inflation (10.9%) over the same reporting period.
31. Participants in the over 35-year age group recorded less than a quarter (23.1%) of total claims but more than a third (35.2%) of total costs. Further research is warranted to identify the risks and injury incidence contributing factors and possible rules modifications for this age group to assist in reduction of injuries.
32. Further research into soccer related concussion related injury entitlement claims and costs may help identify the extent of the difference between males and female soccer participants.
33. Author Statements
34. Contributor Statement
35. DK and TC contributed to the conception and design. DK involved in the acquisition of data. DK, TC and PH contributed to an analysis and interpretation of data. DK, TC and PH involved in the participated in drafting of the manuscript. DK, TC and PH involved in the critical revision of the manuscript for important intellectual content.
36. Competing Interest
37. The authors declare that there are no competing interests associated with the research contained within this manuscript.
38. Funding Source
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