



SPORTS PERFORMANCE
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KNOWLEDGE ATTITUDES AND BEHAVIOURS (KAB) SURVEYS ON CONCUSSION IN SPORTS: SECONDARY SCHOOL STUDENTS SEPTEMBER 2018 SURVEY

REPORT #1 TO ACCIDENT COMPENSATION CORPORATION (ACC)

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OVERVIEW

The purpose of the study was to compare the knowledge, attitudes and behaviours of a group of New Zealand Secondary School Students to sports related concussion (SRC) before and after a social media intervention from the Accident Compensation Corporation (ACC). This report is the first report in a series presenting the changes in Knowledge Attitudes and Behaviours (KAB) around concussion in sport.

The 'Sports Concussion in New Zealand ACC National Guideline' was released in 2014. The KAB studies aim to assess current knowledge and attitudes of secondary school students, coaches, parents, referees, equestrian riders and health professionals towards concussion in sport following release of the guideline and to see if the social media campaign from ACC had an impact on KAB.

The results from the *Secondary School Students September 2018 Survey compared to the 2017 Survey* suggest that the student-based sample of 1347/3756 (35% response rate) have not changed significantly around the knowledge items assessed. They remain knowledgeable regarding concussion and show positive attitudes towards correct management of the injury. However, students expressed a need to know more about how concussion happens, and its prevention and management. Twenty eight percent of participants reported experiencing a previous concussion compared with 35% in 2017. The number reporting 1-2 episodes of concussion has reduced from 40% in 2017 to 25% in 2018. Students reported receiving most information on concussion from medical professionals and their school. Sports clubs may need to be more proactive in concussion education for their particular sport. There is still only a small percentage recognising ACC as a source of information and guidance for concussion (10% in 2018 vs 8% in 2017).

Recommendations

- Further education is required to increase understanding of some of the symptoms of sports concussion including amnesia, nausea and insomnia. Changes to simpler terms (e.g. difficulty remembering things, feeling sick and problems sleeping) in the ACC guidelines and educational material, and in the ACC KAB surveys, may be needed to ensure students understand what the terms mean.
- Further education is needed with regards to the fact that onset of symptoms of concussion may not be evident immediately following injury and can emerge up to several days following injury.
- Further education is needed regarding the time frames to return to sport – noting that the physiology of the brain is the same no matter what the sport, but that different sports have

different recommendations on management. In NZ the current ACC guidelines should be used as the minimum time frame for return to sport.

- Further education is required regarding the potential impacts of multiple concussions.
- Further education is required regarding avoiding the use of devices that may affect cognitive function after concussion.
- Further education is required regarding how head gear use does not reduce the risk of concussion and may increase the risk due to change in athlete behaviour.
- Sports clubs may need to take a more active role in sports concussion education given rates of information provision from them was reported to be low. Sports clubs are able to be more proactive than health professionals who students see only after an injury has occurred.
- Continuing education programmes are required to ensure the current overall high levels of knowledge in the student group remain high. Schools and medical professionals are key but ACC visibility can improve.
- Awareness of the ACC Guidelines can be further increased.
- Knowledge changes over time need to be measured to assess the effectiveness of ACC (and other groups) concussion strategies.

INTRODUCTION

The aims of the KAB concussion research programme are to undertake surveys of secondary school students, coaches, parents, referees, equestrian riders and health professionals to understand their current knowledge and attitudes towards the management of concussion. This report presents an overview of the findings from secondary school students.

The key outcomes of this review are:

- A comprehensive overview of the KAB of sports related concussion in secondary school students, after the implementation of the ACC Sports Concussion Guidelines and the Social Media Campaign 2018.
- Recommendations of the key areas where improvements can be made to improve KAB of sports related concussion.

Sport related concussion is a significant problem in New Zealand sporting populations (Theadom et al., 2014). It has been estimated that 21% of all traumatic brain injuries (TBI) are sustained in the sports arena. Rugby, cycling and equestrian activities have been identified as the most common cause of mild-TBI/concussion in sports (Theadom et al., 2014).

In 2006, a survey of 600 NZ Secondary school rugby players (Sye et al., 2006), demonstrated that at that time, only half of the players were aware of any guidelines for the management of concussion. Approximately half of the players also identified they had been concussed but only 22% had been medically cleared to return to sport. This demonstrated a significant lack of understanding of the management of this condition.

In 2014 The Accident Compensation Corporation (ACC, 2014) released a guideline on the management of sports concussion. A study of secondary school rugby players in NZ (Murphy et al., 2015) collected data on concussion awareness just prior to the release of the ACC guideline. Whilst knowledge of concussion was generally good, more than half of the players felt that they didn't know enough about concussion and reported that their response to concussion would depend on the nature of the game. For example, if the student perceived the importance of the game was high, such as in a season final, they reported they should play on for the sake of the team, but if it was only a training session or weekly game, then they would not play.

Purpose

The purpose of this report is to compare the results of the *Secondary School Students September 2017 Survey* with the *Secondary School Students September 2018 Survey* to investigate if there has been a change in knowledge, attitudes and behaviours around sports related concussion guidelines and management for secondary school players following an ACC social media campaign in 2018.

METHODOLOGY

Data collection process

The *Secondary School Students September 2018 Survey* was undertaken in the months of September to December in the areas outlined in Table 1.

Table 1: Secondary School Students September 2018 Survey areas and sports.

Event	Sport	Venue and date	Projected numbers
National Secondary Schools Tournament	Rugby League	Bruce Pulman Park, Auckland, September 3 rd -7 th Sept 2018	528
Jock Hobbs U19s Tournament	Rugby	Taupo, September, September 8 th –15 th 2018	400
Schick Premierships AA Zone 2	Basketball	Rotorua Events Centre September 5-7 th	330
AA Secondary Schools Premierships Zone 2	Basketball	Tauranga, September 5 th –8 th 2017	370
Harbour - Schick Premierships AA Zone 1	Basketball	North Shore Events Centre September 5 th –8 th 2018	370
Schick Northern Cup	Basketball	Bruce Pullman Park Papakura, September 5-7 th 2018	250

NZ Secondary School Champs	Netball	Blake Park Maunganui Road. Mt Maunganui 3 rd to 6 th Sept	1488
National Age Groups Tournament.	Football Random sample	Wellington December 10-15	47
Total			3756
Completed surveys			1347
Response rate			35%

The methodology used to ascertain the Knowledge Attitudes and Behaviours (KAB) of the secondary school students used a cross-sectional questionnaire design. The 35-item multi-choice questionnaire for the students was designed based on previous studies of this nature by Murphy et al (2015), Sye et al. (2006) and Register Mihalik et al. (2013). Four additional questions on behaviours towards SRC were added to the 2018 survey that were not included in the 2017 survey. Ethical approval was provided by AUTEK Application # 16/187. The ACC Ethics Committee also approved the study.

Participants and their recruitment

Participants were 16 years of age or older, had to be involved in organised coached secondary school sports or have recently left school. Of the 3756 estimated attendees at the attended sports events, 1347 students were recruited (See Table 1), therefore the response rate was 35%.

Intervention

Between the 2017 and 2018 data collection points ACC delivered a social media campaign to all school students, parents and coaches attending tournament week (3-7 September 2018). This coincided with the same week as the KAB data collection at the tournaments listed in Table 1 above. There was one post via the ACC SportSmart Facebook page each day of the tournament on a different aspect of concussion management. The following key messages were delivered:

- Suspect a concussion? If in doubt, sit them out. Concussion is serious - a doctor needs to check the player before they get back into the game.
- If you have a concussion, patience is key. It can take time for the brain to heal so it's important to allow yourself time out to ensure you are symptom free. Only get back onto the field once your doctor has said it's ok.
- What does a concussion look like? If a player seems confused, slower than usual, or is unbalanced remove them from play and get them checked by a doctor.

- If a mate takes a knock in the game and looks like they're having a hard time with easy tasks, talk to them. A lack of concentration, blurry vision and feeling sick or vomiting can be symptoms of concussion.
- Recognise the signs - <https://accsportsmart.co.nz/concussion/>

The posts had a combined reach of 3,938 people, 521 engagements, 33 likes, 19 shares, and one comment.

Data analysis

All data were analysed descriptively via SPSS. Means and standard deviations and 95% confidence intervals are reported as appropriate for the data gained. *T* tests were used to investigate between group comparisons for key variables. The *p* value was set at 0.05.

RESULTS

Participants

Table 2 details the demographic characteristics of the participants who completed the survey. The gender mix of those who completed the survey was altered in 2018 with 60% female compared to 18% female in 2017. The number who identified as New Zealand Pakeha ethnicity increased from 49% in 2017 to 75% in 2018. In 2017, Rugby Union was the most common sport played (52%) whereas in 2018 Netball was the most common sport (50%). Those with at least four years of playing experience increased from 70% to 87%. The age range recruited was the same for both years (mean age 17 ± 1.0 years).

Table 2: Demographics of the 807 secondary school students who completed the *Secondary School Student 2017 Survey* vs the 1347 who completed the *Secondary School Student 2018 Survey*

Demographic characteristic	Mean \pm SD or (frequency%)	
	2017	2018
Age	2017 Mean age 17 ± 1.1 (95% CI 16.9, 17.31) range 16-20 2018 Mean age 17 ± 1.0 (95% CI 16.9, 17.03) range 16-21	
Gender	Male 661 (82) Female 142 (18)	Male 511 (39.1) Female 792 (60.9)
Ethnicity	New Zealand Pakeha 398 (49) Māori 187 (23) Pacific Islands 151 (19) Asian 42 (5) Other 24 (3) Middle Eastern 5 (0.6)	Pakeha 755 (75.8) Māori 443 (34) Pacific Islands 295 (22.6) Asian 50 (3.8) Other 24 (3) Middle Eastern 22 (1.7)
Main sport played	Rugby Union 418 (52) Basketball 294 (36) Netball 44 (5) Rugby League 29 (4) Other 19 (2) Soccer 2 (0.2)	Rugby Union 297 (22.7) Basketball 340 (26) Netball 656 (50.2) Rugby League 61 (4.7) Other 119 (9.1) Football (soccer) 27 (2.1)
Type of school	Co Ed 394 (49) Left school 205 (25) Single sex male 139 (17) Single sex female 61 (8)	Co Ed 832 (36.3) Left school 225 (17.2) Single sex male 94 (7.2) Single sex female 179 (13.7)
Highest level of participation	Regional 350 (43) School 251 (31) National 176 (21) Club 22 (3) Recreational 5 (0.6)	Regional 589 (45.1) School 522 (40) National 210 (16.1) Club 139 (10.6) Recreational 12 (0.9)

Number of years played	4 years 570 (71)	4 years 1157 (87.6)
	3 years 76 (9)	3 years 78 (6)
	2 years 65 (8)	2 years 46 (3.5)
	1 year 56 (7)	1 year 30 (2.3)

Knowledge of concussion

Table 3 consists of the responses of the 20 knowledge items in the survey. Participants were able to choose more than one answer in this section of questionnaire. A t test of the mean scores for overall knowledge items was not statistically different from 2017 to 2018-the range of correct answers was between 7 and 20 for both years, with a mean of 15.22 in 2017 (SD :2.46) and 15.22 in 2018 :2.45). $t=0.000$, $p=1.00$) There was very little difference in the response rates by sport code. The term concussion was known to 93% (94% in 2017) of participants. The most common signs and symptoms identified for concussion increased in 2018. These were blurred vision (79% 2017 vs 86% 2018), confusion (76% 2017 vs 81% 2018), dizziness (82% 2017 vs 84.5% 2018), headache (84% 2017 vs 87.1% 2018) and loss of consciousness (65% 2017 vs 70.1% 2018). There was a reduction in the source of concussion information from a medical professional (56% 2017 vs 43% 2018), teachers and coaches (54% 2017 vs 49% 2018), with sports clubs remaining the same (17% vs 17.3%). Information on guidelines was still low with respect to ACC (8% 2017 vs 10% 2018).

Regarding decision-making related to returning to training and games after a concussion, a doctor was correctly identified by the majority of participants (87% 2017 vs 91% 2018) as the most competent person to judge when a player was ready to return to sport.

Gaps in knowledge of concussion included the ability to understand what amnesia was. Insomnia and nausea were less well-known persistent symptoms of concussion. Whilst loss of consciousness was identified as a key symptom this was true for only 65% in 2017 vs 70% in 2018 of participants. There was an increase in those who thought that head gear would reduce concussion, with 56% recognising this was incorrect in 2017 and only 47% in 2018. There was a small increase in awareness that blue screen devices such as a phone to deliver text messages and similar activities that require cognitive function may need to be avoided until symptoms have settled. (40% 2017 vs 48.5% 2018) There was a small increase in the number indicated that it was safe to return to play only when symptoms have resolved (34% 2017 vs 44% 2018).

Table 3: Knowledge of concussion of the 807 secondary school students who completed the *Secondary School Student 2017 Survey vs 1347 Secondary School Student 2018 Survey*. Data by code is also presented. Data are presented as frequency (%) unless otherwise stated.

Knowledge Items Please indicate which statements you would consider to be a sign or symptom of concussion:	Frequency (%) of correct answers		Rugby	League	Netball	B'Ball
	2017	2018				
Skin rash (false)	781 (97)	1268 (97)	235(96.8)	60(98.4)	635(96.8)	331(97.4)
Abnormal sense of smell (false)	755 (94)	1171(88.4)	262(88.2)	54(88.5)	589(89.8)	295(86.8)
Abnormal sense of taste (false)	751 (93)	1174 (89)	266(89.6)	54(88.5)	589(89.8)	297(87.4)
Joint stiffness (false)	747 (93)	1160(88.8)	266(89.6)	56(91.8)	583(88.9)	299(87.9)
Bleeding from the mouth (false)	731 (91)	1160(88.8)	265(89.2)	57(93.4)	585(89.2)	296(87.1)
Fever (false)	725 (90)	1107 (84.8)	244(82.2)	52(85.2)	555(84.6)	294(86.5)
Black eye (false)	717 (89)	1108 (84.8)	263(88.6)	49(80.3)	547(83.4)	287(84.4)
Bleeding from the nose (false)	662 (84)	991(75.9)	233(78.5)	54(88.5)	494(75.3)	249(73.2)
Sharp burning pain in neck (false)	674 (83)	1027(77.7)	233(78.5)	54(88.5)	512 (78)	265(77.9)
Dizziness (true)	660 (82)	1104(84.5)	248(83.5)	40(65.6)	577(88)	267(78.5)
Headache (true)	675 (82)	1137(87.1)	270(90.9)	47(77.0)	578(88.1)	272(80.0)
Bleeding from the ear (false)	649 (80)	996(76.3)	209(70.4)	55(90.2)	512(78)	258(75.9)
Blurred vision (true)	638 (79)	1124 (86.1)	256(86.2)	46(75.4)	574(87.5)	277(81.5)
Confusion (true)	613 (76)	1058 (81)	257(86.5)	44(72.1)	528(80.5)	261(76.8)
Weakness in neck movements (false)	547 (68)	824 (62.8)	197(66.3)	49(80.3)	387(59)	226(66.5)
Loss of consciousness (true)	522 (65)	917 (70.1)	205(69)	34(55.7)	480(73.2)	230(67.6)
Nausea (true)	388 (48)	759(58.1)	180(60.6)	28(45.9)	389(59.3)	182(53.5)
Amnesia (true)	317 (40)	725 (55)	152(51.2)	27(44.3)	371(56.6)	190(55.9)
Numbness or tingling of the arms (false)	628(78)	982 (75.2)	204(68.7)	50(82.0)	501(76.4)	262(77.1)
Insomnia (true)	108 (13)	249 (19.1)	52(17.5)	7(11.5)	124(18.9)	70(20.6)
Which of the following players would you say might be "concussed"?						
A player complains of stinging or burning in his calf muscles (false)	778 (96)	1261 (96.6)	282(94.9)	57(93.4)	637(93.1)	329(96.8)
After a big knock/fall/head clash the player starts making wrong decisions or actions during the game (true)	546 (68)	912 (69.8)	224(75.4)	45(73.8)	430(65.5)	242(71.2)
After a ruck/fall/head clash a player is left on the ground not moving (true)	534 (66)	1017 (77.9)	220(74.1)	39(63.9)	539(82.2)	245(72.1)
A team mate is complaining of headaches and blurred vision (true)	507 (63)	913 (69.9)	220(74.1)	37(60.7)	454(69.2)	232(68.2)
In the team room a couple of hours after the game a team mate complains of					2	

feeling sick with a headache (has not been drinking alcohol) (true)	392 (48)	631 (48.3)	205(69.0)	28(45.9)	72(41.5)	148(43.5)
General knowledge						
Concussion is an injury to the (correct answer brain or head)	771 (95)	1275 (97.6)	291 (98)	60(98.4)	647(97.7)	332(97.6)
Concussion only occurs if you lose consciousness (false)	686 (85)	1139 (87.2)	250(84.2)	43(70.5)	578(88.1)	299(87.9)
If you are experiencing concussion signs & symptoms after a head knock or sudden movement to the body you should not return to play (true)	680 (84)	1086 (83)	252(84.8)	45(73.8)	555(84.6)	269(79.1)
What are the possible complications of multiple concussions?						
No complications exist (false)	772 (96)	1256(96)	284(95.6)	55(90.2)	627(95.6)	328(96.5)
Joint problems (false)	693 (86)	1236(94.6)	283(95.3)	59(96.7)	617(94.1)	326(95.9)
Brain damage (true)	583 (72)	994(76.1)	248(83.5)	42(68.9)	482(73.5)	255(75.0)
Memory problems (true)	499 (62)	882(67.5)	214(72.1)	37(60.7)	447(68.1)	207(60.9)
Increased symptoms (true)	318 (40)	582(44.6)	145(48.8)	26(42.6)	279(42.5)	148(43.5)
Increased risk of further injury (true)	306 (38)	640 (49)	146(49.2)	30(49.2)	322(49.1)	165(48.5)
Don't know	98 (12)	182 (13.9)	25(8.4)	6(9.8)	112(17.1)	51(15.0)
What are the possible complications of returning to play too soon?						
No complications exist (false)	786 (97)	1265(96.9)	286(96.3)	58(95.1)	636(97)	329(96.8)
Joint Problems (false)	768 (95)	1192 (91.3)	276(92.6)	54(88.5)	587(89.5)	320(94.1)
Paralysis (false)	627 (78)	982(75.2)	212(71.4)	42(68.9)	499 (76.1)	272(80.0)
Brain damage (true)	517 (64)	878(67.2)	231(77.8)	41(67.2)	411(62.7)	223(65.6)
Increased risk of further injury (true)	478 (59)	898(68.8)	204(68.7)	33(54.1)	470(71.6)	217(64.0)
Reduced sports performance (true)	371 (46)	739(56.6)	160(53.9)	24(39.3)	390(59.5)	176(51.8)
Unsure of answer (false/not selected)	107(13)	172 (13.2)	20(6.7)	6(9.8)	101(15.4)	53(15.6)
If a player gets concussed, how long should they wait before returning to training or games?						
Straight back on	14 (2)	28 (2.1)	9(3)	3(4.9)	10(1.5)	10(2.9)
1week	11 (1)	68 (5.2)	12 (4)	12(19.7)	31(4.7)	23(6.8)
2 weeks	64 (8)	153(11.7)	22(7.4)	3(4.9)	82(12.5)	46(13.5)
3 weeks	74 (9)	276(21.1)	125(42.1)	17(27.9)	92(14)	56(16.5)
4 weeks	74 (9)	207 (15.8)	37(12.5)	11(18.0)	109(16.6)	55(16.2)
When fully recovered	273 (34)	578(44.3)	133(44.8)	23(37.7)	308(47.0)	127(37.4)
Don't know	193 (24)	170(13)	9 (3)	4(6.6)	112(17.1)	54(15.9)
What does headgear prevent?						
Neck injury (false)	767 (95)	1142(87.4)	287(96.6)	55(90.2)	542(82.6)	297(87.4)
Skull fracture (false)	579 (71)	807(61.6)	228(76.8)	45(73.8)	342(52.1)	226(66.5)
Concussion (false)	449 (56)	612(46.9)	185(62.1)	39(63.9)	256(39.0)	162(47.6)
Cauliflower ears (true)	415 (51)	686(52.5)	207(69.7)	33(54.1)	328 (50.0)	139(40.9)

Cuts & grazes (true)	205 (25)	284 (21.7)	111(37.4)	16(26.2)	95(14.5)	70(20.6)
Don't know	83 (10)	118(14.4)	25(8.4)	8(13.1)	93(14.2)	73(21.5)
Don't have contact with sports that use headgear	43 (5)	92(7)	3(1)	2(3.3)	93(14.2)	23(6.8)
Which activities should be avoided following a concussion?						
Gym training (true)	545 (67)	985(75.4)	228(76.8)	38(62.3)	492(75.0)	245(72.1)
Going to sleep (false)	511 (63)	820(62.8)	148(49.8)	43(70.5)	426(62.3)	233(68.5)
TV (false)	453 (56)	613 (46.9)	181(60.9)	38(62.3)	330(50.3)	168(49.4)
Jogging (true)	446 (55)	847 (64.9)	207(69.7)	30(49.2)	442(67.4)	194(57.1)
Texting (true)	317 (39)	634(48.5)	166(55.9)	23(37.7)	307(46.8)	156(45.9)
Facebook (true)	309 (38)	613 (46.9)	165(55.4)	23(37.7)	292(44.5)	154(45.3)
Long walks (true)	259 (32)	471(36)	124(41.8)	16(26.2)	227(34.7)	125(36.8)
School work (true)	257 (32)	491 (37.6)	119(40.1)	20(32.8)	247(37.7)	117(34.4)
Who is the best person to decide return to train/play after a concussion?						
Parents/caregivers (false)	731 (91)	1202 (92)	277(93.3)	55(90.2)	607(92.5)	302(88.8)
Coach (false)	700 (87)	1188(91)	269(90.6)	47(77.0)	607(92.5)	297(87.4)
Doctor (true)	702 (87)	1192(91.3)	268(90.2)	50(82.0)	608(92.7)	302(88.8)
Self (false)	698 (86)	1161(88.9)	264(88.9)	50(82.0)	592(90.2)	290(85.3)
Other (false)	14 (2)	40(3.1)	286(93.3)	59(96.7)	642(97.9)	324(95.3)

Attitudes towards concussion

Table 4 outlines the responses to the attitude items of the survey. These questions examined the current awareness of concussion and how effectively it is presently being managed. Participants tended to “strongly agree” and “agree” (80% 2017 vs 72.4 2018) that guidelines should be followed at school level but there was not change in the view that there was a need to provide better education around concussion and improve reporting (74% vs 75% “strongly agree” and “agree”). There were no statistical differences in attitude responses between 2017 and 2018.

Table 4: Attitudes towards concussion of the 807 secondary school students who completed the *Secondary School Student 2017 Survey* vs the 1347 who completed the *Secondary School Student 2018 Survey*

Scored from a scale of 1 (strongly agree) to 5 (strongly disagree)	Frequency (%)	
	2017	2018
Concussion guidelines should be followed at school level	Strongly agree: 328 (43)	476 (36.4)
	Agree: 282 (37)	470(36)
	Not sure: 79 (10)	238(18.2)
	Disagree: 11 (1)	28(2.1)
	Strongly disagree: 61 (8)	110 (8.4)
Concussions are often not reported	Strongly agree: 89 (12)	193 (14.8)
	Agree: 310 (41)	602 (46.1)
	Not sure: 227 (30)	389 (29.8)
	Disagree: 97 (13)	96 (7.4)
	Strongly disagree: 36 (5)	58 (4.4)
Perceived Seriousness of headache & dizziness after head knock (1 = not serious; 5 = extremely serious)	Not serious: 33 (4)	48(3.7)
	Mildly serious: 106 (14)	137(10.5)
	Moderately serious: 244 (32)	395(30.2)
	Very serious: 269 (36)	540(41.3)
	Extremely serious: 102 (13)	236(18.1)
Players shouldn't participate in physical activity with concussion signs & symptoms	Strongly agree: 240 (32)	523(40)
	Agree: 353 (47)	572(43.8)
	Not sure: 91 (12)	153(11.7)
	Disagree: 32 (4)	36(2.8)
	Strongly disagree: 37 (5)	46(3.5)

It is important to understand how concussion happens	Strongly agree: 337 (45)	668(51.1)
	Agree: 325 (43)	504(38.6)
	Not sure: 59 (8)	119(9.1)
	Disagree: 9 (1)	10(0.8)
	Strongly disagree: 23 (3)	19 (1.5)
It is important to understand concussion prevention	Strongly agree: 373 (50)	641 (49.1)
	Agree: 293 (40)	514(39.4)
	Not sure: 59 (8)	103(7.9)
	Disagree: 8 (1)	20 (1.5)
	Strongly disagree: 20 (3)	17 (1.3)
It is important to understand what to do if you see a concussion	Strongly agree: 436 (58)	666 (51)
	Agree: 248 (33)	508(38.9)
	Not sure: 41 (5)	85(6.5)
	Disagree: 8 (1)	17(1.3)
	Strongly disagree: 16 (2)	5(0.4)
Possible concussion should be reported to medical professional	Strongly agree: 366 (49)	647(49.5)
	Agree: 308 (41)	563(43.1)
	Not sure: 52 (7)	100 (7)
	Disagree: 7 (1)	18(1.4)
	Strongly disagree: 14 (2)	5(0.4)
Coaches & referees should be informed of concussion signs & symptoms	Strongly agree: 364 (49)	708(54.2)
	Agree: 306 (41)	494(37.8)
	Not sure: 55 (7)	90(6.9)
	Disagree: 14 (2)	4(0.3)
	Strongly disagree: 10 (1)	10 (0.8)
Players are not well educated about concussion	Strongly agree: 199 (27)	394(30.2)
	Agree: 350 (47)	588(45.0)
	Not sure: 146 (19)	246(18.8)
	Disagree: 40 (5)	62 (4.7)
	Strongly disagree: 12 (2)	16(1.2)

Behaviour items

There were four additional questions in the 2018 survey that asked about behaviours of players, coaches and referees with respect to the on-field management on concussion. These questions asked participants if they had observed players being encouraged to play if a concussion had occurred. Items were rated from very often to never. See Table 5.

With respect to the question “Have you seen players playing on with a suspected concussion when you thought they should not have”, the majority of respondents stated this rarely or never happened (48.5%) but 26.7% stated this sometimes happened. It was rare or never happened that coaches and referees encouraged players to keep playing (73.7% and 77% respectively). Seventy five percent of respondents stated that it rarely or never happened that players put pressure on other players to play on with concussion. Overall these are positive behaviour responses.

Table 5: Behaviours towards concussion of the 1347 secondary school students who completed the *Secondary School Student 2018 Survey*

Scored from a scale of 1 (often) to 4 (never)	Frequency (%) 2018
Have you seen players playing on with a suspected concussion when you thought they should not have?	Very often 186 (14.2) Often 119 (14.6) Sometimes 349 (26.7) Rarely 343(26.3) Never 293 (22.4)
Have you seen coaches allowing players to play on with a suspected concussion?	Very often 37 (2.8) Often 90(6.9) Sometimes 208 (15.9) Rarely 335 (25.7) Never 625 (48)
Have you seen referees/umpires allowing players to play on with a suspected concussion?	Very often 37 (2.8) Often 57(4.4) Sometimes 190 (14.5) Rarely 327(25) Never 678 (51.9)
Have you seen players putting pressure on other players to play on with a suspected concussion?	Very often 58 (4.4) Often 84(6.4) Sometimes 174 (13.3) Rarely 262(20.1) Never 722 (55.3)

DISCUSSION

The main findings of the *Secondary School Student 2018 Survey* suggest that the ACC social media campaign from ACC did not significantly alter the KAB of the participants. The students remained knowledgeable regarding concussion and appear to show positive attitudes and behaviours towards correct management of the injury. There was a general consensus from the students that they wanted to know more about how concussion happens, prevention and effective management. The majority of information on the awareness and management of concussion is coming from schools, teachers and coaches, and medical professionals with some from sports clubs but very little from ACC. An increase in the awareness of the ACC Guidelines and why these are important to follow is still warranted in this group. Some specific gaps in knowledge in terms of onset of symptoms, activities to avoid post-concussion, possible complications of multiple injuries and recognition of amnesia, nausea, trouble sleeping as symptoms of concussion still remain.

Knowledge of concussion

Participants demonstrated the ability to identify common signs and symptoms after a concussion. Blurred vision, confusion, dizziness, headache and loss of consciousness were well recognised by many participants, however a gap in knowledge for most participants was apparent with symptoms that are less obvious, less prevalent and receive less advertisement by mainstream media sources (Sullivan et al., 2011). “Amnesia”, “insomnia” and “nausea” were omitted by 45%, 80% and 40% respectively, indicating a lack of awareness of these resultant symptoms. It remains unclear as to whether this finding reflects a lack of knowledge about the links between the specific symptom and concussion or whether these findings reflect a lack of understanding of these more technical terms used to describe the symptoms. For example, terms such as insomnia and nausea may need different use of language with students such as “problems sleeping” and “feeling sick” respectively.

There were good levels of awareness when participants were asked about which activities should be avoided following a concussion with regards to physical exertion. The negative impact of using technology which can over-stimulate a recovering brain—such as texting, Facebook and school work—had improved slightly when compared to 2017 percentages (48.5 % vs 39%, 46.9% vs 38%, 37.6% vs 32% respectively), however these areas indicate that students are still largely unaware of the impact cognitive exertion can have on recovery after a concussion, and information on “cognitive rest” has not been provided. Cognitive activity imposes additional neurometabolic demand on the brain, and an exacerbation of symptoms can indicate that the recovering brain is operating beyond its limits

(McLeod, 2010). According to McLeod (2010), cognitive rest can be defined as avoiding excessive cognitive activity in the early post-concussion stage, such as using a computer, texting, watching television or schoolwork. This indicates that further information provision is needed in this area.

In addition to these cognitive symptoms, “numbness or tingling of the arms” was only attributed to concussion by 25% of participants (numbness is among the least frequently experienced symptoms). Bleeding from various facial orifices was correctly believed not to be a symptom of concussion by many participants, with only 24% selecting “bleeding from the ear” as correct. These values had increased slightly from the 2017 survey findings. This may indicate that participants had good ability to isolate the brain injury from other facial trauma that may occur simultaneously, and when compared to high school athletes in the United States, this sample demonstrated similar knowledge level in this area (Register-Mihalik, 2013).

Participants were able to apply their concussion knowledge of signs and symptoms practically, and identified scenarios illustrating a player with concussion to a good level. The concussion symptoms exhibited in the scenarios were impaired decision-making, headache, blurred vision, loss of consciousness and nausea, and were correctly identified by approximately 60-70 percent of participants in each hypothetical situation. These were almost identical percentages to the 2017 survey findings. Although they were able to recognise loss of consciousness as a possible indication of concussion, 87% also realised that this does not determine a concussion. It therefore appears that some students were able to recognise a player demonstrating the classic presentation of concussion. However, further education is required for the remaining 10%. Additionally, students were less able (48%) to spot the possible impact of concussion in the scenario when there was a delayed onset of symptoms. The awareness that concussion has a negative effect on performance increased slightly from 47% to 56% but this message still requires further highlighting in education programmes.

It was disappointing to see that less than half (44%) of the students could identify that one should not return to play until all the symptoms had resolved was important. Whilst this response rate has increased from 2017 (35%) this is still a key area requiring further education for all the sports codes. A large percentage (53 %) also believe that head gear can prevent concussion. This is an area that requires significant education in the future.

Attitudes towards concussion

Overall the students have a very positive attitude to the management of concussion and recognise the importance of following the guidelines and recognising symptoms. They also have strong views that concussion is not well managed, and symptoms are often not reported. An increase to 60% agreed that concussion was often not reported, which is similar to the number of secondary students who reported hiding or downplaying sports injuries in another recent survey (Whatman et al 2018). Students do recognise that symptoms need to be reported to medical professionals but also that coaches and referees equally need to be informed when players have symptoms. These results are similar to the findings of Register Mikhalik et al. (2013), who found that high school athletes had good attitudes to the recognition and management of concussion and the symptoms.

Behaviour items

In the 2018 survey, four additional questions were included that specifically asked about player, coach and referee behaviours when dealing with players that might have been concussed. Overall it was rare to see pressure being put on players to continue to play on with concussion. This is a positive finding. From the referee's perspective this positive response particularly in rugby, could be due to the use of the 'blue card' initiative, where referees can remove players from the field of play if there is a suspected concussion. This promotes positive actions of how to manage the condition.

Methods bias

It is noted that those with good KA of concussion may be more likely to want to participate in the study.

CONCLUSION

The results from the *Secondary School Student 2018 Survey* suggest that these 1347 students remain knowledgeable regarding concussion and appear to show positive attitudes and behaviours towards correct management of the injury. There is a general consensus that further education for secondary school students is required to optimise management and improve the awareness of concussion. There was a small reduction in the number of participants who reported experiencing a previous concussion (28% vs 35%). Gaps in knowledge of concussion included: the ability to understand what amnesia was; the fact that insomnia, amnesia and nausea are common symptoms; that players may experience increasing symptoms over time; and that text message and similar activities that require cognitive function may need to be avoided until symptoms have settled. Only 44% of participants understood that players should not to return to sport until symptoms have fully resolved.

Recommendations

- Further education is required to increase understanding of some of the symptoms of sports concussion including amnesia, nausea and insomnia. Changes to simpler terms (e.g. difficulty remembering things, feeling sick and problems sleeping) in the ACC guidelines and educational material, and in the ACC KAB surveys, may be needed to ensure students understand what the terms mean.
- Further education is needed with regards to the fact that onset of symptoms of concussion may not be evident immediately following injury and can emerge up to several days following injury.
- Further education is needed regarding the time frames to return to sport – noting that the physiology of the brain is the same no matter what the sport, but that different sports have different recommendations on management. In NZ the current ACC guidelines should be used as the minimum time frame for return to sport.
- Further education is required regarding the potential impacts of multiple concussions.
- Further education is required regarding avoiding the use of devices that may affect cognitive function after concussion.
- Further education is required regarding how head gear use does not reduce the risk of concussion and may increase the risk due to change in athlete behaviour.
- Sports clubs may need to take a more active role in sports concussion education given rates of information provision from them was reported to be low. Sports clubs are able to be more proactive than health professionals who students see only after an injury has occurred.
- Continuing education programmes are required to ensure the current overall high levels of knowledge in the student group remain high. Schools and medical professionals are key but ACC visibility can improve.
- Awareness of the ACC Guidelines can be further increased.
- Knowledge changes over time need to be measured to assess the effectiveness of ACC (and other groups) concussion strategies.

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