

Why Professional Football Players Chose Not to Reveal Their Concussion Symptoms During a Practice or Game

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Abstract

Objective: To determine why professional football players in Canada decided not to seek medical attention during a game or practice when they believed they had suffered a concussion. **Design:** Retrospective survey. **Setting:** Preseason Canadian Football League training camps. **Participants:** Four hundred fifty-four male professional football players. **Main Outcome Measures:** Reasons athletes did not seek medical attention for a presumed concussion during the previous season, how often this occurred and how important these reasons were in the decision process. **Results:** One hundred six of the 454 respondents (23.4%) believed they had suffered a concussion during their previous football season and 87 of the 106 (82.1%) did not seek medical attention for a concussion at least once during that season. The response “*Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself*” was the most commonly listed reason (49/106) for not seeking medical attention for a presumed concussion. Many players answered that they did not seek medical attention because they did not want to be removed from a game (42/106) and/or they did not want to risk missing future games (41/106) by being diagnosed with a concussion. **Conclusions:** Some professional football players who believed they had suffered a concussion chose not to seek medical attention at the time of injury. Players seemed educated about the concussion evaluation process and possible treatment guidelines, but this knowledge did not necessarily translate into safe and appropriate behavior at the time of injury.

Key Words: concussion, symptoms, professional, football, reasons

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INTRODUCTION

Concussions are a constant concern for health professionals who provide care for athletes. Although some have estimated that millions of sport-related and recreation-related concussions occur each year in Canada and the United States, it is believed that a significant percentage of these concussions go unrecognized, undiagnosed, and untreated.^{1–4} Making the diagnosis of concussion as soon as possible is vital to managing concussions properly and preventing further injury. Athletes who continue to play while symptomatic from a concussion are believed to be at risk for more severe injury, and repeated concussions may also result in progressive and cumulative neurologic and neuropsychological impairment.^{5–11}

There is no loss of consciousness and no obvious external signs in the vast majority of sport-related concussions.^{2,12} Any obvious signs exhibited by an athlete may be very transient and not observed by medical personnel.^{11,13} Several professional leagues now employ “spotters” whose sole responsibility is to watch

a competition and its visual media coverage to alert appropriate medical staff if they visualize behavior suggestive of a concussion in any of the athletes competing.^{14,15} Although this may help identify some athletes who may have suffered a concussion, physicians, therapists, and trainers are often dependent on athletes coming forward to volunteer their symptoms to make the diagnosis of a concussion.

It has been documented that many athletes do not volunteer their symptoms once they have sustained a concussion.^{11,16–18} There are several reasons why athletes may not volunteer possible concussion symptoms. Some athletes do not understand that they may have suffered a concussion, some deliberately choose not to reveal their symptoms for fear of being prevented from playing their sport, whereas others fear being ostracized by teammates by coming forward with symptoms, or by having their standing on the team (or league) affected by a concussion diagnosis.^{16–26} The present study was undertaken in an effort to better understand why professional football players playing in Canada who believed they had suffered a concussion while playing professional football “hid,” or decided not to volunteer, their symptoms to medical staff. This study used an almost identical questionnaire to a recently published study addressing university athletes.¹⁸ The primary objective was to identify specific reasons why athletes who believed they had suffered a concussion during a game or practice decided not to seek attention from medical staff at that time, how often these reasons occurred, and how important these reasons were in the decision process. The secondary objective was to determine if there were individual variables that made athletes more likely to not volunteer their

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Clinical Relevance

Medical staff should be aware that professional football players who believe they have suffered a concussion may choose not to volunteer their symptoms during a game or practice for a variety of personal and athletic reasons.

symptoms to a therapist/trainer or physician during a game or practice.

METHODS

The Canadian Football League (CFL) is a professional league with teams in 9 different Canadian cities. All players attending the 2016 preseason training camp physicals for each team were asked to participate in the study pertaining to their previous season of football. For most players, their previous season would have been in 2015. The 2015 CFL season consisted of 2 exhibition, 18 regular season, and up to 3 playoff games per team. Teams are allowed to dress 44 players per game. There are 24 players on the field at any given time; 12 for each team. The number of players invited to the 2016 preseason training camp physicals varied for each team and exact numbers were not provided to the authors. There were 512 players on the CFL's 2015 opening day rosters and over the course of the 2015 season, due to player turnover, 662 players participated in at least one game.²⁷

One hundred questionnaires were mailed during the off-season to each team's head trainer/therapist. At the 2016 preseason physicals for each team, athletes were given a study information and consent form. If the athletes agreed to participate, they were asked to complete an anonymous questionnaire (Appendix A). Anonymous questionnaires have been used in past concussion research and have been shown to be more effective than traditional prospective data collection in providing a more accurate assessment of the actual incidence of head injuries and concussions.^{22,23,28,29} As stated above, the questionnaires used were almost identical to those used in a recently published study with university athletes.¹⁸ When the questionnaires were completed, they were collected by the team trainers/therapists and mailed by post or delivered in person to the study authors.

For each categorical variable of interest, we report counts and percentages. For continuous variables, we report median and interquartile range because neither of them showed evidence of normality. In the cohort of players who felt they had experienced a concussion while playing their sport during a game or practice in the previous season, we considered those athletes who either always or never sought medical attention during the game or practice; athletes who had both behaviors were excluded. We compared their proportions and examined variables that may have predisposed to not seeking medical attention during a game or practice for a presumed concussion. Associations between these groups and whether the player had past diagnosed concussion, position(s) played, and whether they had played in the CFL during the 2015 season were all investigated with χ^2 tests for independence.

We also compared the distribution of values for number of years playing football, and for number of past concussions, between these groups, using Wilcoxon Rank Sum test. All analyses were done using SAS, version 9.3 (SAS Institute Inc,

Cary, North Carolina). All statistical hypothesis tests were 2-sided and performed at the 0.05 significance level.

Approval was obtained from the "X" university research ethics board before contacting participants. Similar to past concussion research with CFL athletes,²³ both the Canadian Football League management and the executive of the Canadian Football League Players' Association (CFLPA) endorsed the study and were actively involved in ensuring the project's fruition by ensuring the players and the team trainers/therapists were apprised of the protocols and goals of the study.

RESULTS

There were a total of 454 athletes who answered the questionnaire. The demographic information for those athletes is listed in Table 1. From all of the 454 athletes who responded (All athletes group), there were 309 who had played in the CFL during the previous 2015 season (CFL group). This represents 46.7% (309/662) of the players who played at least a portion of the 2015 CFL season. The numbers of athletes who had experienced a previously diagnosed concussion and when these occurred are listed in Table 2.

Table 3 identifies the athletes who felt they had suffered a concussion during the previous season and how often they did or did not seek medical assessment. There were 106 (23.4%) of all the athletes who responded to the questionnaire and 86 (27.8%) of the 309 athletes in the CFL group who felt that they had suffered a concussion during a game or practice during their previous season. The majority of athletes who felt they had suffered a concussion "hid," or did not volunteer their concussion symptoms, at least once during their previous season of football (87/106 or 82.1% in All athletes group, 68/86 or 79.1% in CFL group). There were at least 166 self-diagnosed concussions that were not medically assessed in the 87 athletes from the All athletes group who hid at least one concussion, whereas there were at least 148 self-diagnosed concussions that were not medically assessed in the 68 athletes from the CFL group who did the same.

Table 4 lists the reasons those athletes who felt they had suffered a concussion during a game or practice did not seek medical attention or volunteer their symptoms to a physician or therapist/trainer during a game or practice, and the medians of how important these reasons were. The reason "*Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself*" was listed most frequently as a cause for not seeking medical attention for a presumed concussion for all athletes and those who played in the CFL during the 2015 season.

We found no statistically significant difference in the proportions of athletes who never sought any medical attention during a game or practice for their self-diagnosed concussions, and those who always did. We found no significant association or difference between these groups and having a past diagnosed concussion, position(s) played, number of years playing football, number of prior concussions, and having played in the CFL during the 2015 season.

DISCUSSION

Previous research involving professional football players in the Canadian Football League revealed that a significant percentage of the players who had suffered a concussion during the 1997 football season were unaware that they had

TABLE 1. Demographics of Athletes Responding to Questionnaire*† (N = 454)

	All Athletes (N = 454)	Played in CFL in 2015 (n = 309)‡
Age at time of study	26 (24-28)	27 (25-29)
Age started playing sport	12 (8-14)	12 (9-14)
How many years played organized tackle football		
Pre-high school	2 (0-5)	1 (0-4)
High school	4 (3-4)	4 (3-4)
Junior College or CEGEP§	0 (0-1)	0 (0-2)
University	4 (3-5)	4 (3-5)
Other¶	0 (0-0)	0 (0-0)
Professional	2 (0.5-5)	3 (2-6)
Years played all football	15 (12-17)	15 (12-17)
How many played the previous year in CFL (2015)	309 (68.8%)	N/A
Number games played in previous year of football	11 (4–18)	15 (8–20)
Position played primarily	(n = 443)	(n = 306)
Quarterback	25 (5.6%)	21 (6.9%)
Running back	31 (7.0%)	21 (6.9%)
Wide receiver/slot back	77 (17.4%)	49 (16.0%)
Offensive line	70 (15.8%)	51 (16.7%)
Tight end	3 (0.7%)	3 (1.0%)
Defensive line	65 (14.7%)	45 (14.7%)
Linebacker	39 (8.8%)	23 (7.5%)
Cornerback/safety	76 (17.2%)	44 (14.4%)
Punter/kicker	10 (2.2%)	8 (2.6%)
Special teams	46 (10.4%)	41 (13.4%)
Full back	1 (0.2%)	0
History of Past Concussions#	188 (42.2%) (n = 446)	150 (49.2%) (n = 305)
If yes to past concussions, the number of past concussions		
1	112 (59.6%)	85 (56.7%)
2	42 (22.3%)	34 (22.7%)
3	24 (12.8%)	21 (14.0%)
4	4 (2.1%)	4 (2.7%)
5	4 (2.1%)	4 (2.7%)
7	1 (0.5%)	1 (0.7%)
8	1 (0.5%)	1 (0.7%)

* Data reported as n (%) or median (IQR).

† IQR: Interquartile range: 25% percentile to 75% percentile.

‡ 46.7% (309/662) of the players who played at least a portion of the 2015 CFL season.

§ CEGEP is a level of schooling for athletes in some areas of Canada that encompasses grade 12 and 13 but may be completed over a 2-year to 3-year period of time.

¶ "Other" includes city leagues or semiprofessional level.

|| Data for position primarily played in the last season were missing from certain players in each group (11 from All athletes group and 3 from CFL group).

Data for past concussions were missing from certain players in each group (8 from All athletes group and 4 from CFL group).

suffered a concussion.²³ Over the past 20 years, there has been a greater public awareness of concussions due to media attention and targeted concussion education programs.^{30,31} The CFL has had a formal concussion policy in place since 2010, which includes athlete education and guidelines for the diagnosis and management of concussions. Researchers believe that educating athletes about the signs, symptoms, and dangers of continuing to play while symptomatic from a concussion may make athletes more forthcoming with an initial concussion injury.^{32,33}

If the ultimate goal of athlete education is to change behavior to better protect players from the immediate and

possible long-term effects of concussions, it is important to understand why some athletes may choose not to seek medical evaluation for a self-diagnosed concussion and how often this occurs. Although the diagnosis of a concussion should only be made after examination by a medical professional knowledgeable in sport-related concussions, very often the first step in this process is an athlete recognizing that they may have suffered a concussion and seeking assessment by team medical staff or other healthcare professionals. In this study, a minority of athletes who believed they had suffered at least one concussion during the previous season of football reported always seeking medical attention (17.9% in All athletes

TABLE 2. Past Diagnosed Concussions in Athletes Answering Questionnaire

Athletes With No Past Diagnosed Concussions	Athletes With Past Diagnosed Concussions	No. of Concussions Suffered at Each Level of Sport†						
			Pre-High School	High School	CEGEP‡	University	Other§	Professional
A) All Athletes (N = 446)*								
258 (57.8%)	188 (42.2%)	One	13	58	13	98	0	42
		Two	1	3	1	14	0	13
		Three	0	1	0	5	0	3
		Four	0	1	0	1	0	0
B) Only Athletes Who Played in the CFL During the Previous 2015 Season (n = 305)*								
155 (50.8%)	150 (49.2%)	One	10	51	11	78	0	38
		Two	1	2	1	9	0	12
		Three	0	1	0	4	0	3
		Four	0	1	0	1	0	0

* Data for past concussions were missing from certain players in each group (8 from All athletes group and 4 from CFL group).
 † Athletes with a diagnosed past concussion may have had these at more than one level of sport.
 ‡ CEGEP is a level of schooling for athletes in some areas of Canada that encompasses grade 12 and 13 but may be completed over a 2-year to 3-year period of time.
 § "Other" includes city leagues or semiprofessional level.

group, 20.9% in CFL group). However, the majority of athletes who believed they had suffered at least one concussion during the previous season of football did not volunteer at least one concussion episode (82.1% in All athletes group, 79.1% in CFL group). Similar to past research, the reason

“Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself” was listed as the most common reason for not seeking medical attention for a presumed concussion in all respondents and the CFL group as well.^{16,18} Although many of the concussed players seemed to know the protocol for concussion evaluation would involve removing them from the game for evaluation and that they could miss future game or practices, their decision to continue playing may indicate that they were not aware of the risks of continuing to play with a concussion, they did not believe those risks were very serious, or they decided to ignore those risks. This underscores an important reality in athlete and patient education in general; knowledge transfer does not necessarily lead to a change in behavior.

Results from experimental research indicated that some participants were not more likely to report concussion symptoms after participating in an educational intervention.^{34,35} After attending a concussion education program, some high school athletes reported that they intended to protect themselves from future concussions by modifying their in-game behaviors.³⁴ In recent years, there has been growing interest among concussion researchers to use behavior change theories (eg, theory of planned behavior; TPB) to study athletes’ intentions to report concussions.^{36,37} Theory of planned behavior has been used extensively to frame health behavior change research over the past 30 years and posits that intention to change a health behavior is the best predictor of actual change.³⁸ Although the integration of behavior theory into concussion-related research is still in its early stages of development, medical and behavioral scientists should work together to investigate how these and other behavior change theories³⁸ could be integrated into concussion education as a way to encourage athletes to better self-report their concussion symptoms.

Also of interest in terms of understanding and eventually changing athletes’ behavior is appreciating that athletes may behave differently under similar situations at different points in time. The same athlete may decide not to volunteer symptoms during one episode and volunteer during another.

TABLE 3. Athletes Who Felt They Had Likely Suffered a Concussion During the Previous Season (N = 454)

	All Athletes (N = 454)	Played in CFL in 2015 (n = 309)
Athletes with concussion*	106 (23.4%)	86 (27.8%)
Athletes who ALWAYS volunteered their symptoms	19/106 (17.9%)	18/86 (20.9%)
Athletes who NEVER volunteered their symptoms	69/106 (65.1%)	53/86 (61.6%)
Athletes who did not volunteer their symptoms at least once	87/106 (82.1%)	68/86 (79.1%)
Athletes who sometimes volunteered and other times hid their symptoms	18/106 (17.0%)	15/86 (17.4%)
Minimum number of concussions athletes did not volunteer†	n = 87	n = 68
1	57 (65.5%)	42 (61.8%)
2	10 (11.5%)	6 (8.8%)
3	10 (11.5%)	10 (14.7%)
4	3 (3.5%)	3 (4.4%)
5	3 (3.5%)	3 (4.4%)
8	1 (1.2%)	1 (1.5%)
9	1 (1.2%)	1 (1.5%)
10	2 (2.3%)	2 (2.9%)

* Athletes who felt that they had suffered a concussion during the previous season. For CFL players, this would have been the 2015 CFL season.
 † This refers to the highest number that any of the individual reasons for not volunteering their concussion symptoms was listed and not a combination of the individual reasons.

TABLE 4. Reasons That Athletes Who Felt They Had Suffered a Concussion During a Game or Practice Did Not Seek Medical Attention or Volunteer Their Symptoms to a Physician or Therapist/Trainer (N = 106)				
Reason	Athlete Group	No. of Athletes	No. of Times This Occurred for Each Athlete	Median of How Important* (IQR†)
1a. Wanted to finish the game or practice and planned to seek medical attention after the game	All athletes (N = 106)‡	41 (38.7%)	One = 28	8 (5-9)
			Two = 5	
			Three = 5	
			Four = 1	
			Five = 2	
	Played in CFL in 2015 (n = 86)§	32 (37.2%)	One = 21	8 (5-9)
			Two = 3	
			Three = 5	
			Four = 1	
			Five = 2	
1b. If you wanted to finish the game or practice and planned to seek medical attention after the game, how often did you actually seek medical attention after the game or practice?	All athletes (n = 41)¶	3 (7.3%)	Zero = 38	N/A
			One = 1	
			Two = 2	
	Played in CFL in 2015 (n = 32)	2 (6.3%)	Zero = 30	N/A
			One = 1	
			Two = 1	
2. You felt that you would be removed from the game by the medical staff and you did not wish this to happen	All athletes ‡	42 (39.6%)	One = 29	8 (7-9)
			Two = 8	
			Three = 3	
			Four = 0	
			Five = 2	
	Played in CFL in 2015§	36 (41.9%)	One = 24	8 (7-9)
			Two = 7	
			Three = 3	
			Four = 0	
			Five = 2	
3. Fear of letting the team or teammates down by being removed from the game	All athletes ‡	40 (37.7%)	One = 27	8 (6-10)
			Two = 7	
			Three = 5	
			Four = 1	
			Five = 3	
	Played in CFL in 2015§	35 (40.7%)	One = 20	8 (6-9)
			Two = 6	
			Three = 5	
			Four = 1	
			Five = 3	
4. Fear that being diagnosed with a concussion would result in your missing future games or practices	All athletes ‡	41 (38.7%)	One = 31	8 (6-10)
			Two = 5	
			Three = 3	
			Four = 0	
			Five = 2	
	Played in CFL in 2015§	34 (39.5%)	One = 25	7 (6-10)
			Two = 4	
			Three = 3	
			Four = 0	
			Five = 2	

TABLE 4. Reasons That Athletes Who Felt They Had Suffered a Concussion During a Game or Practice Did Not Seek Medical Attention or Volunteer Their Symptoms to a Physician or Therapist/Trainer (N = 106) (Continued)

Reason	Athlete Group	No. of Athletes	No. of Times This Occurred for Each Athlete	Median of How Important* (IQR†)	
5. Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself	All athletes ‡	49 (46.2%)	One = 36	8 (6-8)	
			Two = 7		
			Three = 4		
			Four = 0		
			Five = 1		
			Six = 0		
			Seven = 1		
	Played in CFL in 2015§	42 (48.8%)	One = 31	8 (6-8)	
			Two = 5		
			Three = 4		
Five = 1					
6. You had similar symptoms of a concussion in the past and felt that there was little or no danger as you had no problems with previous concussions or similar symptoms in the past	All athletes ‡	28 (26.4%)	One = 18	7 (5-8)	
			Two = 6		
			Three = 2		
			Ten = 2		
	Played in CFL in 2015§	26 (30.2%)	One = 17	7 (5-8)	
			Two = 5		
			Three = 2		
			Ten = 2		
	7. Fear that being diagnosed with a concussion would affect your standing with the current team or future teams	All athletes ‡	31 (29.2%)	One = 24	8 (5-10)
				Two = 3	
Three = 3					
Four = 1					
Played in CFL in 2015§		29 (33.7%)	One = 22	8 (6-10)	
			Two = 3		
			Three = 3		
			Four = 1		
8. Fear that being diagnosed with a concussion would result in negative of repercussions from the coach or coaching staff	All athletes ‡	19 (17.9%)	One = 12	6 (4-10)	
			Two = 3		
			Three = 4		
	Played in CFL in 2015§	16 (18.6%)	One = 9	6 (3.5-9.5)	
			Two = 3		
			Three = 4		
9. Fear of being isolated from the team or teammates by being removed and having to take time off from the team	All athletes‡	15 (14.2%)	One = 11	6 (5-8)	
			Two = 2		
			Three = 1		
			Four = 1		
	Played in CFL in 2015§	12 (14.0%)	One = 8	5.5 (5.0-7.5)	
			Two = 2		
			Three = 1		
			Four = 1		
10. Normally you would have sought medical attention but the concussion occurred during an important game or at an important time of the season	All athletes ‡	25 (23.6%)	One = 22	8 (5-9)	
			Two = 2		
			Three = 1		
	Played in CFL in 2015§	22 (25.6%)	One = 19	8 (5-9)	
			Two = 2		
			Three = 1		

TABLE 4. Reasons That Athletes Who Felt They Had Suffered a Concussion During a Game or Practice Did Not Seek Medical Attention or Volunteer Their Symptoms to a Physician or Therapist/Trainer (N = 106) (Continued)

Reason	Athlete Group	No. of Athletes	No. of Times This Occurred for Each Athlete	Median of How Important* (IQR†)
11. Fear that being diagnosed with a concussion would cause concern and worry among family or friends	All athletes ‡	13 (12.3%)	One = 8	5 (3-8)
			Two = 2	
			Three = 3	
	Played in CFL in 2015§	9 (10.5%)	One = 6	5 (3-8)
			Two = 0	
			Three = 3	
12. Fear that being diagnosed and labeled with a concussion could affect your financial income now or in the future	All athletes ‡	28 (26.4%)	One = 22	8 (5.5-10.0)
			Two = 2	
			Three = 2	
			Eight = 1	
			Nine = 1	
	Played in CFL in 2015§	18 (20.9%)	One = 12	8 (6-10)
			Two = 2	
			Three = 2	
			Eight = 1	
			Nine = 1	
13. The injury did not occur when any medical personnel were present and you did not have time or desire to go to a medical clinic or hospital to be examined	All athletes ‡	4 (3.8%)	One = 4	3.5 (1.5-5.5)
	Played in CFL in 2015§	3 (3.5%)	One = 3	5 (2-6)
14. Other reasons for not volunteering symptoms	All athletes ‡	0	N/A	N/A
	Played in CFL in 2015§	0	N/A	N/A

* Median score of how important each reason was most of the time for not seeking medical attention or volunteering their concussion symptoms to team medical staff, based on a 0 to 10 scale (where 0 is not important at all, 5 is moderately important, 10 is very important).
 † IQR = Interquartile range from 25% percentile to 75% percentile.
 ‡ There were 106 athletes from all of 454 athletes who felt that they had suffered a concussion during their last season of football.
 § There were 86 athletes from the 309 respondents who played in the CFL in 2015 who felt that they had suffered a concussion during the previous 2015 CFL football season.
 ¶ There were 41 athletes from all of 454 athletes who answered that they did not seek medical attention because they wanted to finish the game or practice and planned to seek medical attention after the game or practice.
 ¶ There were 32 athletes from the 309 respondents who played in the CFL in 2015 who answered that they did not seek medical attention because they wanted to finish the game or practice and planned to seek medical attention after the game or practice.

There were 18/106 (20.9%) athletes from the All athletes group and 15/86 (17.4%) from the CFL group who both volunteered and hid concussion symptoms during the previous season. Some athletes acknowledged that they did not report symptoms because “Normally you would have sought medical attention but the concussion occurred during an important game or at an important time of the season” (25/106 or 23.6% in All athletes group, 22/86 or 25.6% in CFL group). Although athletes may behave differently during separate self-diagnosed concussion episodes, they also may change their behavior during the same episode. When those athletes who answered that they wanted to finish the game or practice before seeking medical attention were asked “how often did you actually seek medical attention after the game or practice?,” only a minority of athletes (3/41 or 7.3% in All athletes group, 2/32 or 6.3% in CFL group) actually did so.

The behaviors and beliefs of the professional football players were very similar to those previously seen in Canadian university athletes involved in a number of different sports.¹⁸ For example, 72/92 (78.3%) university athletes who believed they had suffered a concussion during the previous year did not seek medical attention during a game or practice at least

once during that time.¹⁸ This percentage is very similar to the professional athletes in this study where 87/106 (82.1%) of all the athletes who believed they suffered a concussion and 68/86 (79.1%) in the CFL group did not seek medical attention during a game or practice at least once in the previous season. The university athletes also listed “Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself” as the most common reason for not seeking medical attention when they believed they had suffered a concussion. There were some minor differences seen between the university and professional groups. A smaller percentage of professional players listed the reason “The injury did not occur when any medical personnel were present and you did not have time or desire to go to a medical clinic or hospital to be examined” (4/106 or 3.7% for All athletes group, 3/86 or 3.4% for CFL group) as compared to the 15/92 (16.3%) of university athletes. This was not unexpected as there are often less trainers or therapists available to cover university athletics compared to a professional football team. There was a higher percentage of professional football players who did not seek medical attention for a self-diagnosed concussion due to “Fear that being diagnosed and labeled with a concussion could affect your financial income now or in the

future” (28/106 or 26.4% in All athletes group, 18/86 or 20.9% in CFL group), but the numbers were not drastically higher as 11/72 (15.2%) of university athletes provided the same response.

The underreporting of concussions cited by the professional football players in this study is similar to other athlete populations and general emergency department patients.^{18,36,37,39} Specific to athletes, Kroshus et al³⁶ found that 16- to 20-year-old hockey players did not report concussions because of the perceived outcomes (eg, did not want to be withheld from competition) or norms (eg, not being allowed to start playing or practicing when players think they are ready) that would stem from being forthcoming about their concussion symptoms. In a similar manner, Register-Mihalik et al³⁷ surveyed male and female high school football, cheerleading, soccer, and lacrosse athletes and concluded that intention to report concussions might not always result in actually reporting the event. Consequently, future researchers may wish to investigate this topic using a wider variety of elite and recreational athletes to determine if the attitudes and actions of concussed athletes are indeed similar across many different sports, ages, and skill levels.

Limitations

The study is retrospective in nature and as such it is possible that respondents can forget symptoms, self-diagnosed concussion episodes, and their decision-making process. Future research that takes place at the end of a season may decrease these possibilities. Collecting data at the end of a season would be more difficult logistically however, given that teams end the season at different times depending on how far they progress into the playoffs. The true response rate of all athletes participating during 2016 preseason physicals is unable to be determined as the number of players invited to the preseason training camp physicals varied for each team and exact numbers were not provided to us by the teams.

The questionnaire used also does not allow for identification of which specific symptoms resulted in an athlete self-determining that they had suffered a concussion, whether severity of specific symptoms was more important in their decision-making process, or what specific symptoms might have led players to report or not report an episode of suspected concussion. The questionnaires were answered anonymously. Although this makes it impossible to confirm or gather further data from respondents, it was decided that they would be less inhibited in answering an anonymous questionnaire. Athletes have expressed concerns during past concussion research that identifying themselves on concussion questionnaires may lead to the information somehow being used against them in the future.²³ The fact that the questionnaires were answered in a physical space where team staff were present, and the fact the questionnaires were distributed and collected by team therapists/trainers, may have resulted in some athletes still being fearful of indicating that they hid concussions in the past, perhaps leading to an underestimation of the concussion underreporting problem that exists within this population.

CONCLUSIONS

A majority of professional football players who believed they had suffered a concussion chose not to disclose this information to

medical personnel at least once during their previous football season. Many did not believe that their concussion was serious and many felt that because they had suffered similar episodes in the past, there was little or no danger to them if they continued playing. Players seemed to be educated about the concussion evaluation process and possible treatment guidelines, but this knowledge did not translate into safe and appropriate behavior at the time of injury. Future concussion research may wish to study ways to ensure that knowledge transfer to athletes results in decisions that can improve player health and safety at the time of injury.

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APPENDIX A. Information Sheet for Survey on Concussions

Principal investigators: J. Scott Delaney, M.D., McGill University; Gordon Bloom, PhD, McGill University.

Purpose: You are being asked to fill out this survey to help researchers better understand the diagnosis and treatment of concussions in sport.

Confidentiality: The information contained in this questionnaire is solely for the use of the researchers. The surveys are **anonymous** and will always be kept **confidential**. The surveys will not be released to any third parties (within the limits of the law). Your answers are **anonymous** and are not made public to the team (management or staff). As such, your answers will **not** affect your position with the team or your chances of making the team. The surveys are the property of the researchers.

There is a chance that the information from these surveys will be used at some point in the future for a publication. As the surveys are **anonymous**, any data used for such a publication would be done without revealing your identity or any identifying information.

The Canadian Football League Players' Association (CFLPA) has endorsed this study during their April 2015 Annual General Meeting (AGM).

Possible benefits: By collecting the information obtained from these surveys, the researchers hope to learn more about the diagnosis of concussions and athletes' understanding of symptoms of a concussion. This will be useful to the researchers and to you, the players. It is hoped that the information collected will help medical staff better diagnose and treat concussions.

Participation: Your participation is voluntary and you can withdraw at any time without consequence to you. Whether you choose to participate or not, your position with the team will not be affected. The survey should take **10 to 15 minutes to complete**.

Consent procedure: By completing the survey, it is assumed that you have consented to the study. If you have any questions, you can contact the investigators. You will be given a copy of this consent form upon request.

Contact Persons: Please contact the following persons if you have any questions regarding the survey.

Dr. J. Scott Delaney (McGill University): Office (514) 398-7007.
Dr. Gordon Bloom (McGill University): Office (514) 398-4184 (ext. 0516).

SECTION 1: FOOTBALL HISTORY

1. How old are you now?

2. At what age did you start playing organized tackle football?

3. How many years have you played organized tackle football?
 - a) Pre-high school football _____
 - b) High school football _____
 - c) Junior College/CEGEP football _____
 - d) University football _____
 - e) Other (Major Junior, Semiprofessional, etc.,) _____
 - f) Professional _____
4. How many years TOTAL have you played ALL types of organized tackle football?

5. Did you play in the CFL last year (ie 2015 season)?
YES _____ NO _____
- If NO:
 - a) In which league did you play your last game? (ex. NFL, University, Arena League, etc.) _____
 - b) In what year did you play your last game? (ex. 2015, 2014, etc.) _____

6. Approximately **how many games did you play last season?**
 (Please also include exhibition, preseason and playoff games)_____
- Note: 2015 CFL season = 2 exhibition + 18 regular season + up to 3 playoff games
7. Which was your **primary position** (most often played) **last year?**
 (Circle your response—may circle **only one** answer)
- Quarterback
 - Running back
 - Wide receiver/slot back
 - Offensive line
 - Tight end
 - Defensive line
 - Linebacker
 - Cornerback/safety
 - Punter/kicker
 - Special teams
- (Special teams = Kickoff team, Kickoff return, Punting team, Punt return)
8. Which **other position(s)** did you play last year?
 (Circle your response—may circle **more than one** answer)
- Quarterback
 - Running back
 - Wide receiver/slot back
 - Offensive line
 - Tight end
 - Defensive line
 - Linebacker
 - Cornerback/safety
 - Punter/kicker
 - Special teams
- (Special teams = Kickoff team, Kickoff return, Punting team, Punt return)

QUESTIONS 9 AND 10 APPLY TO ALL OF YOUR PAST CONCUSSIONS AND HEAD INJURY EXPERIENCES (NOT ONLY IN FOOTBALL BUT IN ALL ASPECTS OF YOUR LIFE)

Note: Duration of symptoms for the following questions can be listed in number of **seconds, minutes, hours, days, weeks, etc.,**.

9. Prior to 2015 season, have you ever been told that you had a **concussion?**
 YES _____
 NO _____
- If **YES**, how many times did you have a concussion?
 Please also list the **longest duration** that you had symptoms from the concussion.
- Number pre-high school _____ Longest duration _____
 - Number in high school _____ Longest duration _____
 - Number in Jr. college/CEGEP _____ Longest duration _____
 - Number in university _____ Longest duration _____
 - Number in other _____ Longest duration _____
 - Number in professional _____ Longest duration _____
- If **YES**, who *usually* told you that you had a concussion?
 (Please check one)
- If it was someone *other* than the trainer/team doctor (ex. you decided yourself, nurse, parent, coach), please specify who it was.
- Pre-High School: Trainer ___ Team doctor ___ Other (explain) _____

- High School: Trainer ___ Team doctor ___ Other (explain) _____
 - Jr. college/CEGEP: Trainer ___ Team doctor ___ Other (explain) _____
 - University: Trainer ___ Team doctor ___ Other (explain) _____
 - Professional Trainer ___ Team doctor ___ Other (explain) _____
 - Other: Trainer ___ Team doctor ___ Other (explain) _____
10. Prior to last year, have you ever suffered a **serious head injury** that was not a concussion (ex, Skull fracture, brain bleed etc.)?
 YES _____
 NO _____
- If **YES**, please explain what occurred, how old you were, and where you were treated.
- _____
- _____
- _____
- _____

SECTION 2: CONCUSSIONS IN THE PAST 12 MONTHS

This section deals with concussions that occurred while you were playing organized tackle football in the past 12 months.

- How often do you believe you suffered a concussion while playing football in the past 12 months?
 _____ times
- How often did you seek medical attention or volunteer your symptoms to a therapist/trainer, doctor or other medical staff **during** the game or practice when you believed you suffered a concussion playing football?
 _____ times
- How often did you seek medical attention or volunteer your symptoms to a therapist/trainer, doctor or other medical staff **after** the game or practice when you believed you suffered a concussion playing football?
 _____ times

For Questions 4 to 17

Within the past 12 months, when you believe you likely suffered a concussion playing football but did NOT seek medical attention or volunteer your concussion symptoms to medical staff during the game or practice, how often and important were the following reasons for NOT seeking medical attention.

Note

- # of times refers to how often this was a reason to NOT volunteer your symptoms to medical staff during the game
- How important** each reason is scored on a 10 point scale where:
 0 is not important at all
 5 is moderately important
 10 is very important
- You can **choose more than one answer** as several reasons may have been involved in your decision not to seek medical attention during a game.

Reasons for not volunteering symptoms of a concussion to medical staff:

4. Wanted to finish the game or practice and planned to seek medical attention after the game or practice.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)

- c) how often did you actually seek medical attention after the game or practice? _____ times

5. You felt that you would be removed from the game or practice by the medical staff and you did not wish this to happen.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

6. Fear of letting the team or teammates down by being removed from the game or practice.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)

7. Fear that being diagnosed with a concussion would result in your missing future games or practices.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)

8. Did not feel the concussion was serious/severe and felt you could still continue to play with little danger to yourself.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)

9. You had similar symptoms of a concussion in the past and felt that there was little danger, as you had no problems with previous concussions or similar symptoms in the past.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

10. Fear that being diagnosed with a concussion would affect your standing with the current team or future teams.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

11. Fear that being diagnosed with a concussion would result in negative repercussions from the coach or coaching staff.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

12. Fear of being isolated from the team (or teammates) by being removed and having to take time off from the team.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

13. Normally you would have sought medical attention but the concussion occurred during an important game or at an important time of the season.
 a) # of times this occurred: _____ times
 b) how important was this reason most of the time:

 0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

14. Fear that being diagnosed with a concussion would cause concern and worry among family or friends.

a) # of times this occurred: _____ times

b) how important was this reason most of the time:

0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

15. Fear that being diagnosed and labeled with a concussion could affect your financial income now or in the future.

a) # of times this occurred: _____ times

b) how important was this reason most of the time:

0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

16. The injury did not occur when any medical personnel were present and you did not have time or desire to go to a medical clinic or hospital to be examined?

a) # of times this occurred: _____ times

b) how important was this reason most of the time:

0 1 2 3 4 5 6 7 8 9 10

(1 is not important at all, 5 is moderately important, 10 is very important)

17. Please list *any other reasons* that affected your decision NOT to volunteer your concussion symptoms to medical staff during a game or practice:

Reason 1: Please explain reason: _____

a) # of times this occurred: _____ times

b) how important was this reason most of the time:

0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)

Reason 2: Please explain reason: _____

a) # of times this occurred: _____ times

b) how important was this reason most of the time:

0 1 2 3 4 5 6 7 8 9 10

(0 is not important at all, 5 is moderately important, 10 is very important)