

# KNOWLEDGE AND ATTITUDES TOWARD CONCUSSION AMONG ELITE CANADIAN JUNIOR ICE HOCKEY PLAYERS: AN EXPLORATORY STUDY

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## ABSTRACT

**Objective:** Concussion is a common injury in ice hockey and numerous misconceptions surround it among players. Effective educational interventions are needed to address these misconceptions, improve the management of concussion in ice hockey, and potentially reduce the incidence of concussion-related sequelae. The purpose of this study was to assess the knowledge of and attitude toward concussion among elite junior-level male ice hockey players in Canada.

**Methods:** An information letter was distributed to the medical and administrative leads of 4 junior hockey teams, and to each subject for review and consent. The survey was administered in a locker room setting at each of the teams' home arenas. The survey consisted of demographic information and the Rosenbaum Concussion Knowledge and Attitudes Survey (RoCKAS) instrument. A descriptive analysis of the results was undertaken.

**Results:** A total of 50 players completed the survey, consisting of 30 forwards, 15 defensemen, and 5 goaltenders. Mean scores for the Concussion Knowledge Index and Concussion Attitudes Index, were 72.2% and 73.2% respectively. On average subjects were able to identify 85.8% of concussion symptoms.

**Conclusion:** The average scores obtained by the participating elite male junior hockey players on the indices demonstrate that further efforts toward concussion educational program development and knowledge transfer remain necessary. (*J Contemporary Chiropr* 2019;2:86-91)

## INTRODUCTION

Sport-related concussion (SRC) is a common injury in contact sports such as hockey, and concussion diagnosis

and management pose a challenge for health care providers. (1,2) Sport-related concussion is defined as "a traumatic brain injury induced by biomechanical forces." (1) It typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. (1) SRC may be caused either by a direct blow to the head, face, neck, or somewhere else on the body with an impulsive force transmitted to the head. (1,3) The majority of SRCs occur without loss of consciousness or frank neurological signs. (1-3)

There is evidence that some athletes inappropriately return to play with ongoing concussion symptoms. (2-4) A growing body of literature indicates that a sizeable minority of youth, high school, and collegiate athletes take much longer than the expected seven to 10 days to recover and return to sport following concussion. (2-4) Some authors have attributed this to recent changes in the medical management of SRC, with adoption of gradual return-to-play recommendations. (3)

Educating athletes on the proper identification and management of sport-related concussion is now a priority in the sports medicine community, as research has indicated that concussion, and particularly repeated concussion, can have both short and long-term functional consequences. (2,4) This is of particular concern for young concussed athletes, given the developmental status of the brain, as well as the potential for additional injury as they grow older and continue to participate in sports. (4) Given the potential complications, athletes need to be aware of concussion mechanisms of injury, symptoms, management, and possible complications. In particular, early recognition and reporting of concussion signs and symptoms is paramount for appropriate management. (1-5) Premature return-to-play increases the risk of complications such as prolonged concussive symptoms or symptoms of depression and cumulative cognitive deterioration. (1-4) Accordingly, it is important that athletes are informed about potential complications and risks associated with premature return-to-play (RTP).

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Previous research has demonstrated the role of athlete beliefs and behavior in both reporting concussion and compliance with RTP protocols. (6-14) This research highlights a tendency for athletes to underreport concussion and to continue playing while symptomatic. Misunderstandings regarding the causes, symptoms, and sequelae of SRC in athletes have been reported. (2-5) More specifically, previous research showed that Canadian minor-league hockey players lack knowledge of concussion symptoms, mechanism of injury, and management. (7) Previous research with high-school football players demonstrated that most concussions that are not reported are due to a lack of knowledge of concussion symptoms and lack of awareness of the possibility of a concussion. (8)

Influencing athlete attitudes toward concussion is complex when considering the knowledge gaps, behavioral norms, and performance pressures faced by athletes. There is a paucity of evidence regarding the effectiveness of knowledge-based interventions toward improving adherence to RTP guidelines, and it may be that increased knowledge alone is insufficient. Effective educational interventions need to be developed to address these gaps in athlete knowledge, improve the management of concussion in ice hockey, and potentially reduce the incidence of concussion-related sequelae. Clinicians are called on to advise players, coaches, and parents on concussion management. It is important for health professionals and other stakeholders to be aware of what players know about concussion as well as their attitudes. The aim of this study was to evaluate the knowledge and attitudes of elite junior-level male ice hockey players in Canada toward concussion.

## METHODS

Ethics approval for this project was obtained from the Canadian Memorial Chiropractic College's Research Ethics Board (certificate #1901B02).

### *Study Design*

A convenience sample of 4 junior level hockey teams was used in this study. An information letter was distributed to each team's medical lead (i.e. head athletic therapist), administrative lead (general manager or president), and to each potential participant for review and consent. The information letter detailed the purpose of the study, risks and benefits of participation, as well as potential limits to confidentiality. Subjects were notified verbally 1 week and then 1 day prior to the study as courtesy reminders of the date, time, and venue. The survey was completed on paper and was proctored by the respective team chiropractors. Players were asked to maintain silence

during the administration of the survey and asked to refrain from using any electronic devices until the survey was complete. Players were reminded that if at any point they did not wish to continue, they were to inform the team chiropractor and be asked to leave the room until all subjects had completed the survey. Completed surveys and signed information/consent forms were collected in an envelope placed at the center of the room. A separate sheet of paper was handed to all subjects to provide their e-mail address if they wished to receive the results of this study upon completion. Care was taken to ensure these sheets were collected in a separate envelope also placed in the center of the room. Players were asked to place all documents in the correct envelope themselves. Team chiropractors were responsible for mailing all documents in sealed envelopes to the authors via secure courier service.

### *Settings and Sample*

Eighty players across 4 junior hockey teams were informed of the study and asked to participate. One team rescinded their participation prior to the commencement of data collection citing a miscommunication of league rules regarding concussion-related research. This left 3 teams (60 players) eligible to participate. The involved teams compete in 3 different Junior A hockey leagues. For each of the teams the survey was administered in a locker-room setting.

### *Questionnaire*

The questionnaire consisted of both demographic information and the Rosenbaum Concussion Knowledge and Attitude Survey (RoCKAS-ST) instrument (<https://bit.ly/2JgjwHC> pp.118-119). The following demographic information was collected: age, height, weight, years playing organized hockey, years playing junior hockey, primary position, and number of concussions sustained. The RoCKAS-ST is a valid and reliable instrument in the evaluation of concussion knowledge. (15) It consists of 5 sections and 40 questions that blend into 2 indices. The Concussion Knowledge Index (CKI) consists of 17 true or false questions, designed to evaluate a subject's knowledge of the causes and sequelae of concussion. (15) The Concussion Attitudes Index (CAI) consists of 15 questions on a 5-point Likert scale with the "safer" response being correct. The CAI is designed to assess a subject's perception and opinion with respect to return-to-play and the effects of concussion. (15) The symptom identification question lists 16 symptoms and asks the respondent to identify the symptoms that correspond to a concussion, only 8 of which are correct. Seven questions do not inform either index or are intended to maintain the validity of the tool. The main outcome measures

were the players' scores on the RoCKAS-ST knowledge and attitude indices as well as responses to individual questions.

### Data Analysis

Surveys were manually entered and the CKI and CAI scores were determined by identifying the number of correct responses and converting them to a percentage, relative to the number of questions for each index. The mean percentage for each index was then calculated and presented here. Similarly, the number of correct symptoms identified by each subject was noted and a mean score was converted to a percentage.

In addition to the mean scores for the CKI, CAI, and symptom identification, the mean, median, and range of number of concussions sustained by the respondents were determined. The mean and range of subject age, total number of years playing hockey, and years of junior-level hockey playing experience were also described.

## RESULTS

### Subject Characteristics

50 players participated in the study, for a response rate of 62.5%. As described above, 1 team declined to participate, removing 20 players from the sample and giving an adjusted response rate of 83.3%. Thirty forwards, 15 defensemen, and 5 goaltenders participated. Their characteristics can be found in Table 1. Half (n=25) of the responding players had suffered at least 1 concussion. The highest average number of self-reported concussions were sustained by goaltenders (2), followed by forwards (0.97) and defensemen (0.93). For players age 17 and under, the average number of concussions sustained was 0.71, whereas for players age 18 and older, the average number of concussions was 1.12.

Table 1. Subject Characteristics (n=50)

VARIABLE	MEAN (MEDIAN, RANGE)
Age	18.68 (18.5, 16-21 years)
Years playing organized hockey	13.76 (14.5, 6-17 years)
Years playing junior hockey	2.24 (2, 1-5 years)
Number of self-reported concussions	1.06 (0.5, 0-5 concussions)

### Concussion Knowledge Index

Participants in this study scored an average of 72.2% (12.28/17) on the CKI (range 5-15, median 13). While the players were typically able to correctly answer a majority of the CKI questions, 5 questions in particular were poorly answered (Table 2). One item relating to the

visibility of physical damage to the brain on imaging after a concussion was answered incorrectly by 78% of the respondents. An item relating to a possible risk of death if a second concussion occurs before the first has healed was answered incorrectly by 36% of the respondents. Another item relating to the duration of symptoms was answered incorrectly by 68% of the respondents. A fourth item relating to forgetting one's identity after a concussion was answered incorrectly by 64% of the respondents. Finally, an item about loss of consciousness and a coma was answered incorrectly by 84% of the group. Of the 16 symptoms listed in Section 5, on average subjects were able to identify 85.8% of the 8 correct symptoms which were amnesia, blurred vision, confusion, dizziness, headache, loss of consciousness, nausea, and sleep disturbances. Of the 8 incorrect detractors, the 3 most commonly selected were weakness of neck range of motion (40 times), sharp burning pain in the neck (21 times), and numbness/tingling in the upper extremity (14 times).

Table 2. Concussion Knowledge Index Responses (n=50)

SECTION 1	CORRECT RESPONSE	TOTAL CORRECT	NO RESPONSE
1	TRUE	31	1
3	TRUE	41	0
5	FALSE	49	0
6	FALSE	47	0
7	FALSE	38	0
8	TRUE	49	0
9	FALSE	44	0
11	FALSE	10	1
12	FALSE	48	0
13	TRUE	16	0
14	FALSE	18	0
16	TRUE	44	0
17	TRUE	7	0
18	FALSE	44	0
SECTION 2			
1	FALSE	40	1
2	TRUE	48	1
3	FALSE	43	1

### Concussion Attitudes Index

The participants in this study scored an average of 73.2% (10.98/15) on the CAI (range 3-15, median 12). While the players typically provided the safer response to the majority of the CAI questions, 3 questions did not reflect that trend (Table 3). When asked if the subjects would

**Table 3.** Concussion Attitudes Index Responses (n=50)

SECTION 3	STRONGLY DISAGREE/ DISAGREE	NEUTRAL	STRONGLY AGREE/ AGREE	NO RESPONSE
1	<b>32</b>	6	12	0
2	0	9	<b>41</b>	0
5	<b>46</b>	4	0	0
6	<b>37</b>	9	3	0
7	6	10	<b>34</b>	0
SECTION 4				
1	1	3	<b>45</b>	1
2	2	11	<b>36</b>	1
3	<b>47</b>	2	0	1
4	<b>42</b>	7	0	1
5	<b>34</b>	9	6	1
6	<b>23</b>	16	10	1
7	4	12	<b>33</b>	1
8	9	13	<b>27</b>	1
9	2	8	<b>39</b>	1
10	5	13	<b>31</b>	1

\* Bolded numbers indicate the correct response

continue playing a sport while also having a headache caused by a concussion, 64% of the players provided the safer response (Strongly Disagree/Disagree), but 24% would continue to play. When asked if most athletes feel an individual should return to play during a semi-final game, 46% of the respondents disagreed and 52% either agreed or were unsure. When asked if a physiotherapist should determine whether an athlete can return to a game or not, 66% of subjects agreed; however, 32% either disagreed or were unsure. Lastly, when asked if most athletes feel that an individual should tell his or her coach about concussive symptoms, 62% of participants agreed while 36% disagreed or were unsure.

## DISCUSSION

Sport-related concussions in young athletes are a significant concern due to the number of athletes affected and potential health risks. In this study of elite junior-level hockey players, 50% of the respondents reported having had at least 1 concussion. Past studies have found the incidence of concussion in youth hockey to range from 10 to 30%; however, there is a paucity of evidence, making estimates difficult. (16-18). The higher prevalence in the current study is not surprising as this sample consists of experienced elite level players who have a high degree of exposure to full-contact hockey.

Past studies have shown that athletes have limited knowledge about concussions. (6-14) However, with a recent increase in concussion awareness, there is greater recognition of their signs, symptoms, and consequences. (1,3). The subjects in this study were generally familiar with common concussion signs and symptoms but still demonstrated some unsafe attitudes regarding return to play. The vast majority of players were able to correctly identify the most common symptoms of concussion, with an average score of 85.8%. This is higher than the 66% found by Viljoen *et al* (14) and the 75% by Anderson *et al* (13) in studies of rugby players and high school football players respectively. The majority of the players scored poorly in questions pertaining to symptom duration; specifically, that most symptoms resolve within 10 days and that others may last several weeks or months. Almost all subjects knew that a concussion can occur without the player being knocked out. However, 36% of the subjects did not know that there is a possible risk of death from a second concussion before the first has healed. This is concerning, as only 62% responded that they would report concussion symptoms to their coach, and 24% indicated that they would continue to play with symptoms of a concussion. Current educational initiatives alone may not be enough to encourage safe behaviors.

When comparing hockey player concussion knowledge and attitudes, the most unsafe behavior dealt with a

scenario that described returning to play in an important playoff game despite having suffered a concussion. While 64% of players correctly answered an item about the risk of death from a second concussion, we are concerned that 52% of players would agree with a concussed athlete playing in an important game. Prior studies utilizing the RoCKAS survey have found similar results in football and rugby players in this age range. (13,14) Viljoen *et al* (14) found that 55% of players would stop their participation in sport while experiencing concussion symptoms while Anderson *et al* (13) found that 54% would report symptoms to their coach and 53% reported that they would always or sometimes continue to play with symptoms of a concussion.

A previous study of Canadian minor hockey players by Cusimano (7) revealed lower scores on knowledge of symptoms of concussion as well as the percentage of players that would report their concussion to their coach. This may be due to the increased age of subjects in our study, additional education on concussions, the longer and more competitive hockey involvement of our sample, and the increased exposure to concussions whether through teammates, family members, or themselves.

This study utilized the RoCKAS-ST survey, which used the term physiotherapist (PT) as the health practitioner making the decision on return to play for a player. While most players agreed with letting the PT determine return-to-play, 32% of players disagreed. Some teams may use different health providers and if a team does not have a PT in such a position it is possible that players misinterpreted the significance of a PT being involved versus a team physician, chiropractor or athletic therapist. For example, the involved teams in this study all have a team chiropractor and may have a working relationship with him or her as opposed to a consulting physical therapist. This may have resulted in the lower score for this question. It should also be noted that Hockey Canada's current concussion guidelines indicate that return-to-play is to be determined by a medical doctor for minor hockey players (19).

Previous studies have demonstrated that lack of concussion knowledge is not necessarily a barrier to athletes reporting concussion. (10,11,20) The unique characteristics of athletes and of competitive sport can lead to specific challenges in achieving successful response to education efforts. Altering the perspective of athletes is complex considering the behavioral norms and performance pressures faced by athletes. Fear of lost playing time or other opportunities or sheer motivation to win can lead players to mask or deny injury symptoms. It is possible that a player's decision to play while still suffering from the effects of a concussion may include considerations for their team's chances of winning as well

as their position and rank within the team. This places added responsibility on the coaching staff, trainers, parents, medical staff, and other potential stakeholders to recognize symptoms of concussion and take the appropriate steps of seeking medical attention and to engender a culture of healthy attitudes and behaviors among their players. Amateur and professional leagues, players, and the media must share this responsibility given the indication that player attitudes play an important role in under-reporting concussion.

### Limitations

The main limitation of this study was the small sample size and use of a convenience sample with which the team chiropractors administering the survey had a pre-existing relationship. This may have affected the level of knowledge and/or attitudes of the players with respect to concussion and may not be representative of all junior-level players and teams, as they may not have direct access to a team chiropractor to engage in a thorough assessment, diagnosis, management, and education.

## CONCLUSION

Future research in this area should employ larger sample sizes and consider different populations, including female players. There is little research examining female players' experiences of concussion, medical care provided to female players, and the incidence of concussion among female athletes. This is important given that recent studies have shown that female players respond less favorably to concussion than male players. (21,22) Further research evaluating effective methods of knowledge transfer and attitude evaluation that lead to safer player behavior are also needed. Further investigation into the education, attitudes, and knowledge of sports-related concussions among involved coaches, parents, team staff, and health professionals is necessary. Finally, more involvement of national sport organizations and sports leagues in concussion-related research would support the ongoing efforts to protect players from potentially damaging health consequences.

The Junior A hockey players who completed the RoCKAS-ST instrument in this study were generally familiar with many common concussion signs and symptoms but gaps in their knowledge were observed and they demonstrated some unsafe attitudes regarding return to play after concussion. This study highlights the ongoing need for improved player education on concussion.

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