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Concussion Knowledge and Reporting Behavior Among Junior Ice Hockey Players

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CONCUSSION KNOWLEDGE AND REPORTING BEHAVIORS AMONG JUNIOR ICE HOCKEY PLAYERS

By

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Barriers to Reporting Concussions in Hockey Athletes

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Introduction: Although it is estimated that 1.6-3.8 million sport-related traumatic brain injuries occur each year, it is also believed that at least 50% of concussions sustained go unreported. Much attention has been given to football in the media and current research; however, ice hockey proves to be a high risk, high incident of concussion sport due to body and/or head collisions at high speeds. Recognizing and reporting concussions continues to be a primary concern for health care providers to ensure a safe return to sport for these athletes and to preserve the long term health of athletes. **Purpose:** The purpose of this study was twofold: 1) to examine what knowledge junior ice hockey players possess regarding concussions, and 2) to determine what, if any, perceived barriers exist in reporting concussions once sustained. **Patients or Participants:** A convenience sample of 19 junior ice hockey players with an average age of 18.6 $\pm$ 0.7 years completed the Concussion Knowledge and Reporting Behaviors Questionnaire (CKRBQ) prior to the start of their season. **Methods**: The researchers combined and modified three existing validated surveys containing closed ended questions about concussion knowledge and consequences of concussions, as well as concussion reporting behaviors to develop the CKRBQ. **Dependent Variables**: Quantitative data from the questionnaire was analyzed using Microsoft Excel to examine concussion knowledge and reporting behaviors. **Results**: 14 athletes reported a history of concussion and reporting most commonly to their coach (n= 10/19) and physician (n= 0/19). 13 athletes reported playing while symptomatic and more than half of the athletes felt pressured at some point to play through a concussion while symptomatic. The most common reasons identified for not

reporting concussions were “not serious enough” and “didn’t think I had one.” Most players were unable to correctly identify all symptoms of a concussion among distractors. **Conclusions**: The athletes in this study scored below average in this study indicating a poor ability to recognize concussion symptoms and long-term consequences of a poorly managed concussion. One of the primary barriers revealed was a lack of awareness of when a concussion occurred and not understanding the severity of playing through the symptoms of a concussion. Future educational efforts should be made to improve concussion knowledge in this group in an effort to minimize the barriers to reporting concussions when they do occur. **Word Count:** 381

Introduction

Concussions have the potential to be extremely dangerous and deadly. Many people involved in sports (whether as athletes, coaches, or supporters) do not entirely realize the severity of concussions.[1] Concussions alone make up a significant portion of collegiate athletic injuries. In epidemiological studies involving fifteen collegiate sports, approximately 5-6% of all collegiate injuries in a year are concussions.[2] An estimated 1.6-3.8 million sport-related traumatic brain injuries occur each year.[2] Student athletes who have sustained a brain injury often fail to report signs and symptoms thereby putting themselves at risk for delayed recovery and potentially permanent impairment. In a recent study conducted at a private university, approximately 38%-45% of college athletes at the university did not report their suspected concussions during their collegiate athletic career and 50% of athletes did not report the suspected concussions of a teammate.[1]

In today's world of contact sports, concussions are of high interest not only to athletic trainers, but also athletes, parents, and coaches. Concussions are typically generated by rapid acceleration, deceleration, or rotation of the head, leading to compressive, tensile, and shearing forces on the brain.[3] Sports-related concussion research generally focuses on assessment, management, and prevention of athletic concussions.[1] A growing body of scientific evidence links concussions and other repetitive brain trauma to short- and long- term neurological deficits. In the acute phase, concussions have been linked to a wide array of symptoms including the following: difficulty concentrating or remembering, sleep disturbances, cognitive deficits, irritability, depression, and suicidal thoughts and behaviors.[4] Although symptoms of most

concussions resolve in less than two weeks, during this period of time the somatic, cognitive and emotional symptoms sustained interfere substantially with an athlete's activities of daily living and pose a significant health burden.[5] In some cases, the neurological consequences may extend across the life course. Behavioral issues, cognitive issues and Chronic Traumatic Encephalopathy (CTE), a neurocognitive disease that presents with changes on cognition, mood and behavior, are potential long- term consequences that result from brain trauma.

It is observed that some coaches, athletic trainers, and parents do not realize exactly how a concussion occurs. There are several different mechanisms of injury in which a concussion occurs. First, a concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an 'impulsive' force transmitted to the head.[6] A concussion typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. A concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.[6] Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course.[6] Also, a concussion is typically associated with grossly normal structural neuroimaging. Perhaps the most common misconception when it comes to recognizing a concussion is the issue surrounding loss of consciousness. Most concussions occur without a loss of consciousness. In fact, loss of consciousness is just one of several possible signs and symptoms of a concussion.[6] Another common misconception surrounding concussions is the idea that one must be hit in the head for a concussion to occur. A significant blow to

either the neck, face, jaw, or elsewhere in the body can result in a concussion, as long as the force is transmitted to the head.[6] Thus, a concussion can occur from what is normally viewed as a legal body check in the sport of hockey. Understanding the mechanism of injury associated with a concussion is vital in diagnosing a concussion.

The lack of appreciation for the seriousness of concussions is a major problem facing athletic trainers and physicians alike. If left unrecognized or improperly cared for, the effects of concussions can outlast the short-term, transitory symptoms, potentially causing lifelong consequences, particularly if subsequent concussions occur.[2] Outwardly visible signs commonly associated with concussions are rare, making self-report of symptoms imperative. This emphasizes the necessity for injury recognition and concussion awareness amongst athletes, parents, coaches and healthcare providers alike, which may improve overall reporting rates.[2] Because concussions are not a visible injury, athletic and medical professionals heavily depend on the individual to self-report his or her concussion. Therefore, it is the purpose of this professional paper to examine why student athletes are failing to report their concussions so the athletic community can take the necessary steps to addressing this problem.[1]

Background

The majority of today's literature focuses on football, as it is a major contact sport. However, it is of importance to focus on a sports such as ice hockey, as it is also a high contact sport where the amount of concussions that occur are just as much, if not more, than football. The rate of injury during ice hockey games for men is 18.69/1000 athlete-exposures and for women 12.10/1000 athletes-exposures.[7] Player contact is the causes of

concussions in game situations for 41% of women and 72% of men.[7] Traumatic brain injury is a serious problem at all levels of ice hockey.[8] Proper diagnosis of a concussion often lies in self-reporting symptoms. However, an estimated 50-80% of concussions remain unreported.[2] Individual case studies have demonstrated that athletes frequently refuse to self-report sustained concussions.

An overarching theme that affects the attitudes of athletes is the culture of sports: athletes are expected to be tough and behave in the best interest of their team rather than themselves. To many athletes, this means shrugging off a "ding" to the head and getting back in to finish the game. The attitude of not wanting to seem inferior due to an invisible injury is detrimental to the health of student-athletes.[1] The responses as to why the suspected concussions were not reported included pressure to play and lack of knowledge about concussions. The four most common reasons for underreporting include: they did not think it was serious enough, did not think it was a concussion, did not want to leave the game, or did not want to let down a teammate.[2] It is well known that social demands and pressures also play a role in concussion reporting. The lack of concussion reporting has individual reasoning, and potentially lies largely upon the concussion knowledge of the individuals involved in making the final healthcare decision. Underreporting is at least partially motivated by a desire to continue playing, with awareness that self-reporting symptoms prolongs return-to-play decisions in.[9]

Given the difficult nature of determining a concussion, how often concussive symptoms are reported vary from 20%-60%. In fact, a recent qualitative study involving 50 varsity athletes found that not one would definitively stop playing when faced with a hypothetical situation in which he or she had experienced concussion. Among the most

common reasons given for failing to report symptoms is lack of knowledge regarding the seriousness of such injury. [10] Another study examined 1,532 football players and found that only 47.3% who incurred a concussion reported their symptoms; "did not think it was serious enough" was the reason given by 66.4% of those who failed to report.[10] Although some have said the lack of education regarding concussions may be the singular underlying cause to underreporting, research has shown that a number of other factors may also play a critical role in this phenomenon.

Common Barriers

Concussion Knowledge

Athletes' perceive lack of severity and minimal knowledge about concussions may result from receiving minimal or no concussion education.[11] One commonly proposed strategy to reduce underreporting has been to educate athletes about concussions. By addressing the lack of knowledge concerning signs, symptoms, and consequences of concussions, 83% of athletes have said they would have reported a concussion if they had understood.[2] Student-athletes may not be reporting because they do not believe the injury was serious enough.[12] In a recent study, 70.2% of a group of athletes did not report their concussions because they did not think it was serious enough.[1] Serious deficiencies in concussion knowledge exist among athletes, coaches, and parents.[8]

The majority of student-athletes are aware of risks, yet continue to play.[12] Despite athletes knowing signs and symptoms, and understanding the dangers of playing with concussion, when faced with concussive scenarios all reported they would continue to play either immediately or with a short break.

Educating athletes, coaches, parents, referees, medical personnel, and the general public is essential. They must be taught that a concussion is a brain injury, the signs and symptoms of a concussion, the risks associated with concussion, return to play protocol, and the risks associated with returning to activity while still symptomatic.[13] One study concluded that more education is necessary for all involved with sports about the potential adverse effects associated with continuing play while symptomatic, failing to report symptoms to medical staff and failure to recognize or evaluate any suspected concussion.[14] At a policy level, states and sports leagues have been increasingly mandating concussion education for players, parents, and coaches. Not all educational materials for athletes have been evaluated, but among those that have, measuring whether symptom focused knowledge changes post-education has been a commonly used evaluation strategy.[15]

Pressure From Coaches

Some research argues that knowledge is not the issue, but that coach approachability adds a barrier in reporting of concussions signs and symptoms. Student-athletes are more likely to report concussive symptoms while playing for a supportive coach.[12] They would hesitate to tell any symptoms to their coach if they were not severe or debilitation, potentially marking coach approachability as an additional underreporting rationale. This adds support to educating not only athletes, but coaches as well to improve communication and provide an open environment for athletes to report concussive injuries.[2]

Team support

Brotherhood and loss of playing time are key factors in the team support aspect of barriers to reporting. Student-athletes may not be reporting because of fear of letting their team down. [12] In a recent study, 27% of athletes stated that they did not report a concussion because they "did not want to let down teammates." It is very possible that coach attitudes about concussions and concussion education are systematically related to team participation. Future research efforts are encouraged to form partnerships with sports leagues and conferences to facilitate higher rates of team participation.[4]

Social identity

Student-athletes may not report concussion symptoms due to the fear of losing player identity.[12] In a recent study, 36.5% of a group of athletes did not report their concussions because they did not want to be removed from a game.[1] Sports are closely linked with a very narrow and strict version of masculinity that privileges toughness, heterosexuality, competitiveness, aggression, playing through the pain. This particular form of masculinity, known as hegemonic masculinity, "refers to the social of ascendency of a particular version or model of masculinity that, operating on the terrain of 'common sense' and conventional morality, defines what it means to "be a man."[11] Hegemonic masculinity is culturally engrained and is deeply embedded in sport.

The rate at which concussions are occurring is rapidly increasing over time and have the potential to be extremely dangerous and deadly. An estimated 1.6-3.8 million sport-related traumatic brain injuries occur each year, thus, properly reporting

them in a timely matter is critical in the treatment process. The lack of appreciation for the seriousness of concussion is a major problem facing athletic trainers and physicians alike. Therefore, concussion knowledge and reporting behavior must be carefully analyzed in order to improve the lack of knowledge and lack of reporting of brain injuries.

Methods

Research Design

A quantitative research paradigm was used based on the scoring of the survey and the lack of open-ended questions for coding purposes. A cross-sectional research design was used for this study to assess concussion knowledge and barriers to reporting. A cross-sectional design is typically used in descriptive studies, with an aim to determine the prevalence of a specific outcome for a population, or subgroup, at a given point in time.

Subjects

A convenience sample of 22 junior hockey players with an average age of 18.6 +/- 0.7 years, completed the Concussions Knowledge and Reporting Behaviors Questionnaire (CKRBQ) prior to a concussion awareness class that was given by the team athletic trainer. The subjects played hockey for an average of 12.8 +/- 3.4 years.

Instruments

The survey consisted of 9 questions to assess concussion knowledge and barriers to reporting concussions. In the survey, athletes were asked to identify symptoms (among distractors) associated with concussions and to identify potential consequences of a poorly managed concussion among distractors. The survey was developed based off of

past surveys related to barriers to reporting concussions.[15,16] Questions from previous research studies were included as well as modified to shape this survey to our research question.[10,17,18,12] They were asked if they have ever sustained a concussion and if they answered yes, they were asked to list how many. If they had experienced a concussion, they were asked whom they reported it to (coach, teammate, parent, athletic trainer, doctor, or other). If they did not report the concussion, they were asked why they did not report it. They were given the options to mark answers as follows: didn't think it was serious enough, didn't know it was a concussion, didn't want to be pulled from practice/game, didn't want to let down anyone, and "other" to be filled in by the athlete if those answers did not suffice.

The athletes then were asked about peer pressure and if they have ever felt pushed to return to play after sustaining a head injury. They were also asked if they had continued to play while experiencing symptoms of a concussion. Both of these questions were "yes" or "no" answers.

Lastly, the athletes were given 5 statements related to concussions and playing while symptomatic and asked to rate them on a scale of 1-10, 1 being not important and 10 being very important. The statements are as followed: 1) How important is it to not participate in physical activity (game or practice) when experiencing symptoms of concussions, 2) How important do you think it is to be informed about how concussions happen, 3) How important do you think it is to be informed about how concussions can be prevented, 4) How important do you think it is to be informed about what to do if you have a concussion, and 5) How important do you think it is to report a concussion to a medical professional or coach. Appendix A contains the full questionnaire.

Procedures

Permissions to conduct this research was acquired though the Institutional Review Board (IRB). Participants were recruited verbally at the beginning of the season, prior to practices and/or any concussion education classes associated with the team's athletic trainer. The questionnaire was administered during a preseason team meeting before practices had begun. The pen and paper survey was administered to the athletes with the only verbal instructions being "read and complete the survey to the best of your ability." Once the survey was completed, they were given to the research study advisor and were not analyzed or looked at until data entry. The survey took approximately ten minutes to complete in the pen and paper format.

Statistical Analysis

Data from each questionnaire was entered into Excel (version 2010; Microsoft Corpoaration, Redmond, WA). Descriptive statistics were used to determine the frequency of each symptom and the consequence of concussions, as well as the percentage of participants who had received education from a formal source. We calculated an overall composite score for each completed survey. The surveys were scored by calculating a composite score for each participant. This was done by coding the correct and incorrect answers to the symptom and consequence questions. Composite scores were generated by adding the total possible correct signs/symptoms and consequences and awarding 1 point for each correctly identified minus 1 point for each distractor selected. The final score calculated was the composite score. The total possible points on the survey is 22. Frequency

counts were conducted on the yes/no responses as well as the likert scale responses. Cronbach's alpha was ran and used to assess the relationship between variables.

Results

We distributed and collected a total of 22 surveys. Only 19 of the 22 surveys were used for the data as athletes had to be at least 18 years old in order for the survey be used for data calculation. Each survey was reviewed for errors or unanswered questions. The athlete average composite score was 12/22, 54%. Cronbach α was calculated for responses on the signs and symptoms scale (athlete Cronbach $\alpha = 0.69$) and consequences (athlete Cronbach $\alpha = 0.39$). ore they

Symptoms

Athletes most commonly identified nausea/vomiting n=18 (95%), neck pain n=18 (95%), sensitivity to light n=19 (100%), sensitivity to noise n=18 (95%), feeling "like in a fog" n=18 (95%), ringing in ear n=17 (89%), poor balance/coordination n=17 (89%), and drowsiness n=17 (89%) (Table 2). Athletes also recognized vacant stare/glassy eyed n=14 (74%), inappropriate emotions n=12 (63%), fatigue or low energy n=10 (53%), and irritability n=8 (42%) (Table 2). The least common symptom that was identified was sadness n=3 (16%) (Table 2). The most common distractors athletes chose were jaw pain n=9 (47%), pale skin n=9 (47%) and difficulty breathing n=6 (32%).

Consequences

Athletes most commonly identified early onset dementia n=18 (95%), persistent headaches n=17 (89%) and persistent dizziness n=15 (79%) as the consequences

associated with inappropriate care of a concussion (Table 3). Other consequences identified were bleeding in the brain n=14 (74%), death n=12 (63%), early onset Parkinson's n=12 (63%), and early onset Alzheimer's n=11 (58%) (Table 3). Athletes improperly identified increased risk of stroke n=9 (47%), persistent neck pain n=15 (79%), increased risk of blindness n=7 (37%) and persistent jaw pain n=10 (53%) as consequences associated with inappropriate care of a concussion (Table 3).

Past Concussion History

When asked if the athlete has sustained a concussion 14 of the 19 surveyors answered that they have sustained a concussion. Between all 19 athletes, a total of 35 concussions have been sustained (Table 4). The average self-reported number amount of concussions the athlete had experienced was 1.84 ± 1.42.

Reporting Behavior

After sustaining a concussion athletes reported to either a coach n=10 (53%), a teammate n=3 (16%), a parent n=8 (42%), an athletic trainer n=9 (47%), or a physician n=10 (53%) (Figure 1). If they chose not to report a concussion, the athlete was asked why they chose not to with 5 options to chose from. The two most common reasons selected were "did not think it was serious enough" n=5 (26%), and "didn't know it was a concussion" n=5 (26%). The only other marked option was "did not want to be taken out" n=2 (11%) (Figure 2). The athletes were then asked about whether or not they have ever felt pressured from coaches, teammates, fans or parents to return to play after sustaining an injury. Seven out of the nineteen athletes (n=7/19) answered yes (37%). When asked whether or not they continued to play while experiencing symptoms of a concussion, over half (n=13/19) answered yes (68%).

Relationship of Composite Scores

Using linear regression, a poor relationship was found between those who reported concussions and their composite score ($r = 0.08$). However, there was a moderate correlation between continuing to play with a concussion and their composite score ($r = 0.39$). This indicated that they more they knew about a concussion, the more they reported to continuing to play with symptoms of a concussion.

Discussion

The number of concussions that go unreported is outstanding. The result from this study confirms the fact that athletes are continuing to not report their concussions, even though they know the signs/symptoms and consequences. There are several different barriers that are associated with lack of reporting. These are barriers that are being identified and reoccurring in several different research studies regarding the lack of reporting concussions. This study analyzed common barriers to reporting that were also presented in past studies in order to see if the data from this study would support and relate to results from past studies.

Concussion Knowledge

The athletes in this study scored below average in this study, indicating a poor ability to recognize concussion symptoms and long-term consequences of a poorly managed concussion. In comparison with other research, the data about concussion knowledge

from this study matches up with other concussion knowledge results from different studies. This finding is not necessarily surprising, as recent research has found that education alone does not mitigate non-reporting of concussions symptoms.[16] More than one third of players who failed to report their injury did not recognize that they had sustained a probable concussion based on their symptoms.[17] However, another result from this study indicates that the more the athlete knew about concussions, the less they would report a sustained concussion. Over half of the athletes in this study reported to playing while symptomatic. Recent research suggests greater knowledge does not equate to being more likely to report concussive signs and symptoms.[12] This reaffirms the notion that a new approach to concussion education must be taken in order for athletes to become aware of the consequences associated with inappropriate care of a concussion. Current concussion education programs are designed to increase knowledge of concussion, signs and symptoms, potential dangers, and return to play guidelines. However, increasing knowledge may not be sufficient to change reporting behaviors.[13] Athletes seem to know what a concussion is and what symptoms are, however may not know the severity of brain damage that could occur when concussed.

Barriers to Reporting

The results from this study indicate that different barriers to reporting are present for different athletes. Athletes in this study also indicated that they did not report a concussion because they either "did not think it was serious enough" or "didn't think they had one." Recent research has found that the most common reason for an injury not being reported was that the player did not think it was serious enough to warrant medical

attention.[17] This is a common reporting behavior that could be fixed with proper concussion education with emphasis on how serious a concussion is or what it really means to "get your bell rung."

Although concussion knowledge seems to still be the number one barrier to reporting, the pressure from teammates, parents, coaches, and even athletic trainers is a barrier to reporting that has been reported in previous research. The athlete's subjective experience of pressure may be in part informed by their personal characteristics and prior experiences.[5] This study indicated that approximately 37% of the athletes surveyed had felt pressured at some point to play after sustaining a concussion. Previous recent research has found that athletes who had been diagnosed with a concussion during the previous competitive season were significantly more likely to have experienced pressure from coaches and teammates than were athletes without a concussion diagnosis during this time frame.[5] Also, college athletes who were away from home perceive pressure from a parent or guardian to continue to play after an impact. Athletes who experience this pressure are less likely to intend to report symptoms of a concussion.[5] Based off of this research and previous research, the pressure associated with returning to play from a concussion is a reoccurring issue. Recent research has found that student-athletes are more likely to report concussive symptoms while playing for a supportive coach.[12] Social identity in today's age takes a toll on student-athletes and how and if they report their injuries to medical personnel. Research is finding that student-athletes may not report concussions due to fear of losing their identity as an athlete. Also, student-athletes may not be reporting because of fear of letting their team down.[12]

Reporting Behaviors

Based off of the results from this study, the athletes exhibited similar reporting behaviors reported in previous research. Over half of the participants (68%) in this study admitted to continuing to play while symptomatic. In a recent study, only 47.3% of athletes who had sustained a concussion reported the event to medical personnel.[17] Another study had 89 individuals with only 15 (17%) indicating that they reported all recalled concussive/bell ringer events experienced to a coach or medical professional. Of the 89 participants, there were 83 recalled concussions. Only 41 (49%) of these events were indicated as reported by the respondents. There were 584 recalled "bell ringer" events, with 72 (12%) indicated as being reported to a coach or medical professional.[19] Overall, an estimated 50-80% of concussions remain unreported.[2] This statistic confirms our results as "within the norm" of reporting behavior numbers. With this number continuing to remain the same in study after study, future efforts must be made in order for the number of unreported concussions to decrease.

Conclusion

Recognizing and reporting concussions continues to be a primary concern for health care providers to ensure a safe return to sport for those athletes and to preserve long-term health of athletes. The lack of knowledge presented by the athletes in this study is apparent. It is also interesting to see that those who did obtain decent concussion knowledge and knew the signs and symptoms of a concussion, still continued to play while experiencing concussion symptoms. This study indicates that health care providers must present concussion information (signs/symptoms, long-term consequences of poorly

managed concussions, etc.) to athletes in a way that would emphasize the long-term risks/potential dangers of sustaining a concussion and not taking the correct steps in recovering from a concussion. Approaching concussion education in a different way may be beneficial to limiting negative reporting behavior and encourage reporting of any head injuries. Future educational efforts should be made to improve concussion knowledge in this group in an effort to minimize the barriers to reporting concussions when they do occur.

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Figure 1: Whom Junior Ice Hockey Players Report to Following a Concussion (n=19)

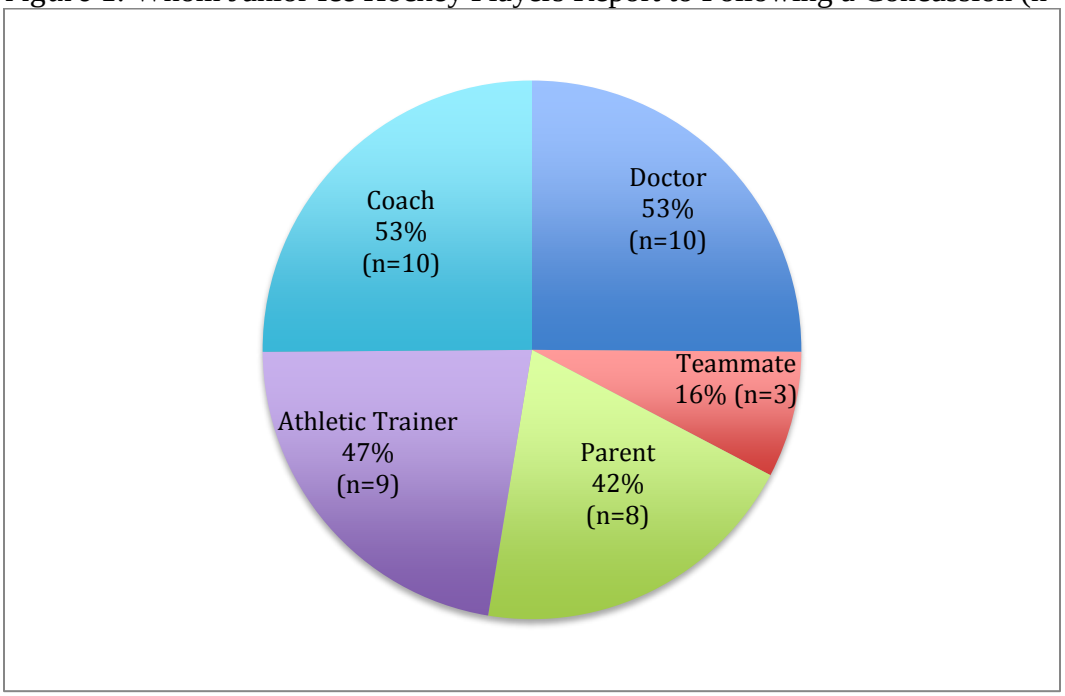

Figure 2: Why Junior Ice Hockey Players Did Not Report a Suspected Concussion (n=19)

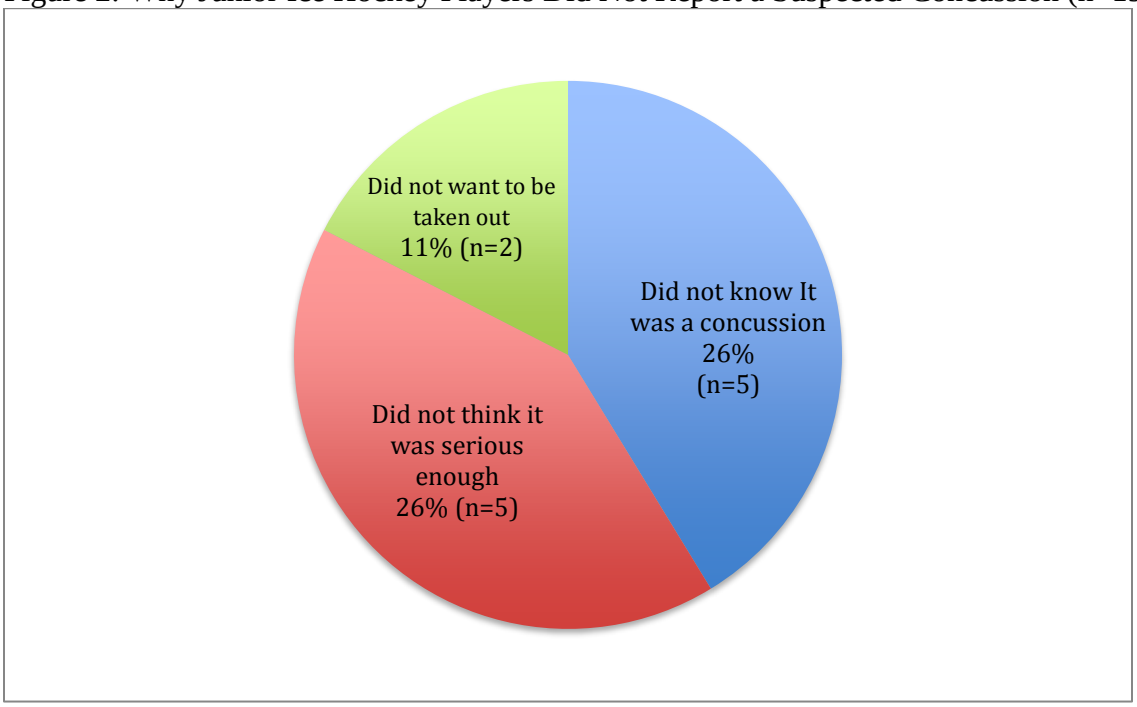

Table 1: Demographic Data Male Junior Ice Hockey Athletes

	Age ± SD	Years Played
Athletes (n = 19)	18.63 ± 0.76	12.83 ± 3.48

Table 2: Frequency of Symptom Identification (n=19)

Symptom:	**No.**	**(%)**
Vacant Stare / Glassy Eyed	14	74%
Drowsiness	17	89%
Nausea or Vomiting	18	95%
Irritability	8	42%
Neck Pain	18	95%
Inappropriate Emotions (out of place feelings)	12	63%
Sensitivity to Light	19	100%
Sensitivity to Noise	18	95%
Feeling like “in a fog”	18	95%
Poor balance/Coordination	17	89%
Fatigue or Low Energy	10	53%
Sadness	3	16%
Ringing in Ear	17	89%
Distractors:		
Difficulty Breathing	6	32%
Pale Skin	9	47%
Neck Spasm	3	16%
Blackeye	4	21%
Epistaxis (nosebleed)	3	16%
Jaw Pain	9	47%

Table 3: Frequency of Consequences of Inappropriate Care of Concussion (n=19)

Consequence:	**No.**	**(%)**
Early Onset Dementia (impaired thinking)	18	95%
Persistent Dizziness	15	79%
Death	12	63%
Persistent Headaches	17	89%
Bleeding in the Brain	14	74%
Early Onset Alzheimer	11	58%
Early Onset Parkinson's	12	63%
Distractors:		
Increased Risk of Stroke	9	47%
Persistent Neck Pain	15	79%
Increased risk of Blindness	7	37%
Persistent Jaw Pain	10	53%

Table 4: Concussion History

	Sustained a Concussion	**How Many**	**Pressure to Play**	**Continued to Play**
Yes	N = 14/19 (74%)	1.84 ± 1.42	N = 7/19 (36%)	N = 13/19 (68%)
No	N = 5/19 (26%)		N = 12/10 (63%)	N = 6/19 (32%)
Total	N = 19	N = 35	N = 19	N = 19

Table 5: Statement Agreement (Scale: 1 Not Important – 10 Very Important)

Statement	Agreement Scale ($\bar{x}$± SD)
How important it is to not participate in physical activity (game or practice) when experiencing signs and symptoms of concussion.	7.58 ± 2.36
How important you think it is to be informed about how concussions happen	8.31 ± 2.40
How important you think it is to be informed about how concussions can be prevented	8.63 ± 1.86
How important you think it is to be informed about what to do if you have a concussion	9.16 ± 1.74
How important you think it is to report a concussion to a medical professional (doctor, athletic trainer) or coach	8.89 ± 2.20

Appendix A: Survey

Concussion Knowledge and Reporting Behaviors Among Junior Ice Hockey Players

Age: _____

How many years have you played hockey? ___

1. Which of the following are <u>symptoms</u> of a concussion after sustaining a hit to the head? **Please circle all that apply.**
    a. Vacant stare/glassy eyed
    b. Drowsiness
    c. Difficulty Breathing
    d. Nausea or Vomiting
    e. Irritability
    f. Neck Pain
    g. Inappropriate emotions (out of place feelings)
    h. Pale skin
    i. Excess Sleep (sleeping longer than usual)
    j. Sensitivity to light
    k. Muscle spasms in your neck
    l. Black eye
    m. Sensitivity to noise
    n. Feeling like "in a fog"
    o. Poor balance/coordination
    p. Epistaxis (bloody nose)
    q. Fatigue or low energy
    r. Jaw pain
    s. Sadness
    t. Ringing in ears

2. Which of the following do you think are <u>consequences</u> of inappropriate care of a concussion? **Please circle all that apply.**
    a. Early onset dementia (impaired thinking)
    b. Increased risk of stroke
    c. Persistent dizziness
    d. Persistent neck pain
    e. Death
    f. Persistent headache
    g. Bleeding in the brain

h. Early onset Alzheimer
i. Increased risk of blindness
j. Early onset Parkinson's
k. Persistent jaw pain

3. Have you ever sustained a concussion?
    a. Yes
    b. No

4. If you answered yes to #3, how many concussions do you think you have experienced? _____

5. If you experienced a concussion, who did you report the concussion to? (**Check all that apply**)
    a. Coach
    b. Teammate
    c. Parent
    d. Athletic Trainer
    e. Doctor
    f. Other _____

6. If you did not report your concussion to anyone, why not? (**Check all that apply**)

    _____ Didn't think it was serious enough _____ Didn't know it was a concussion
    _____ Didn't want to be pulled from practice or game _____ Didn't want to let down teammates
    _____ Other (why?) _____

7. Have you ever felt pressured from coaches, teammates, fans or parents to return to play after sustaining a head injury?
    a. Yes
    b. No

8. Have you ever continued to play while experiencing symptoms of a concussion?
    a. Yes
    b. No

9. For the following statements, please rate your level of agreement (**Circle one number**):

Statement	Not Important									Very Important
How important it is to not participate in physical activity (game or practice) when experiencing signs and symptoms of concussion.	1	2	3	4	5	6	7	8	9	10
How important you think it is to be informed about how concussions happen	1	2	3	4	5	6	7	8	9	10
How important you think it is to be informed about how concussions can be prevented	1	2	3	4	5	6	7	8	9	10
How important you think it is to be informed about what to do if you have a concussion	1	2	3	4	5	6	7	8	9	10
How important you think it is to report a concussion to a medical professional (doctor, athletic trainer) or coach	1	2	3	4	5	6	7	8	9	10