Survey Validation: Perception and Knowledge of Concussions Amongst NCAA Student-Athletes

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SURVEY VALIDATION: PERCEPTION AND KNOWLEDGE OF CONCUSSIONS AMONGST NCAA COLLEGIATE STUDENT-ATHLETES

A THESIS IN
Health and Well-being Management

Presented to the Faculty of Rochester Institute of Technology in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE IN HEALTH AND WELL-BEING MANAGEMENT

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Thesis Committee Members: Professor William Brewer, Dr. John Oliphant
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**ABSTRACT**

*Background:*

Sport related concussion diagnosis can often be challenging as all athletes experience different signs and symptoms and may not have the correct knowledge to be able to identify every possible symptom of a concussion. When a concussion is sustained by an athlete, it is crucial that the injury is handled correctly not only by medical providers, but more importantly by the athlete themselves. Because the most common symptoms being a headache, dizziness, etc., a clinical diagnosis is highly dependent on the patient self-reporting their own symptoms. It is important for an athlete to be able to recognize a concussion symptom, know the risks of sustaining a concussion and having the appropriate knowledge to be able to report a concussion. This study aims to validate a survey that can be used to test NCAA athlete’s knowledge and perception of concussions.

*Methods:*

Twenty-eight questions were prepared following evidence-based research. Questions were removed and adjusted based on experts review. Expert responses were analyzed using I-CVI, S-CVI/Ave, S-CVI/UA to determine content validity and a modified kappa was used to determine the probability of chance amongst expert’s answers.

*Results:*

Eleven experts were used to score the survey along with 66 student-athletes to complete the survey once it was adjusted based on expert review. One question was removed from the survey entirely and another question was modified. A finalized survey of 27 questions was
chosen. The I-CVIs ranged from 0.636 to 1.00, the S-CVI/Ave = 0.93, and the S-CVI/UA = 0.50 was taken as acceptable amongst the 11 experts.

Conclusion:

We conclude that this questionnaire has met the content validity criteria. However, when items were separated into two groups, knowledge and perception, Cronbach’s alpha deemed both groups had poor inter-relatedness between items.
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CHAPTER ONE

Introduction

1.1 Concussion Incidence and Prevalence

Concussion injuries are by nature, non-discriminatory and widespread. The Center for Disease Control (CDC) defines concussion as “a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head.”¹ A concussion occurs when biomechanical force is impacted directly to the head or directly to one’s body causing the brain to move within one’s skull. The term “sport related concussions (SRC) has become globally known within recent decades.²,³ The Concussion in Sport Group ⁵th International Conference⁴ define a SRC as:

1. A direct or indirect trauma anywhere on the body with a force transmitted to the head;

2. Rapid (seconds to minutes) or delayed (minute to hours) symptom presentation, typically with spontaneous resolution;

3. Negative standard neuroimaging (computerized tomography (CT) or magnetic resonance imaging (MRI)), reflecting a functional rather than structural injury;

4. With or without loss of consciousness, with stepwise resolution of symptoms

An estimated 69 million individuals worldwide experience a concussion each year.⁶ In just the United States alone, The CDC reported 2.87 million Traumatic Brain Injury (TBI)-related emergency department visits, hospitalization, and deaths in 2014, of which 812,000 were children 17 or younger.⁶ This number is likely underreporting, as concussions can go unnoticed
by a medical provider or the individual themselves. Additionally, there are approximately 21.47 million children and adolescents between the ages of 6-17 who play sports annually in the United States,\textsuperscript{7} and 500,000 more in the National Collegiate Athletic Association,\textsuperscript{8} all of whom could sustain a concussion during competition.

\subsection*{1.2 Characteristics and Symptoms}

Although concussions occur frequently, they are complex and not entirely understood in terms of pathology and treatment.\textsuperscript{9} Concussion symptoms vary in severity and quantity amongst different individuals. The most common symptoms include headache, dizziness, nausea, and imbalance,\textsuperscript{10} however, other possible symptoms include blurred vision, sensitivity to light and/or noise, difficulty concentrating, difficulty remembering, drowsiness, irritable, sad, nervous and/or anxious, feeling in a fog, feeling slowed down, and all around just not feeling right.\textsuperscript{11} These symptoms can make it very hard for an individual to continue with daily activities such as being in a classroom, in the workforce, or participating in physical activity. It is possible for some individuals to exhibit very little to no change in physical or cognitive function however, one must experience at least one of the symptoms listed above to be diagnosed with a concussion.\textsuperscript{12} One of the most significant risks after a concussion is recurrent injury.\textsuperscript{13} Individuals are at a higher risk of having a recurrent concussion within the first 7 to 10 days after their first concussion, likely due to both a physical vulnerability (poor balance, blurred vision, slowed down, etc.) and a physiologic neuronal vulnerability.\textsuperscript{13,14} When a concussion is mismanaged, it can lead to a catastrophic injury such as second impact syndrome, as seen with 13-year-old Zackery Lystedt.\textsuperscript{15}
1.3 Zackery Lystedt

Within the past 20 years, the level of attention and media coverage that concussions have received has increased considerably. In the early 2000s concussions were often an injury that was pushed aside and went untreated. During this time, concussions were generically referred to as “getting your bell rung,” and because of this, and prior to Zackary Lystedt, a mild traumatic brain injury (mTBI) was largely treated with a simple brief period of rest (~7 days).

In 2006, Zackery, a football player suffered a mTBI from a hit to the head while playing in a game. Zackery remained in the game and later suffered second impact syndrome from a subsequent hit, causing him to collapse after the game. That night, Zackery suffered a hemorrhage in his brain, forcing surgeons to perform a craniotomy to try and relieve the pressure. He was on life support for seven days, a feeding tube for 20 months, and took years to relearn basic everyday skills such as speaking, moving his limbs, walking, etc.

Due to the young 13-year old’s incident, media attention grew around the topic of concussions and emphasis was placed on the importance of protecting young athletes and ensuring they are removed from play to recover accordingly. In 2014, Zackery’s story had gained global knowledge, and to protect future athletes, the Zackery Lystedt Act was passed in every state including the District of Columbia. Amongst other policies that have now been put in place such as the return to play protocol, this law’s main points focus on the following:

1. “Young athletes who are suspected of sustaining a concussion or head injury must be removed from play immediately until cleared by a medical licensed provider;”
2. “All student-athletes and their parents/guardians must read and sign an information sheet about concussion and head injury before the young athlete can begin to play. This must be done at the beginning of each sport season;”
3. “Young athletes who have been removed from play must receive written medical clearance prior to returning to play from a licensed healthcare provider trained in the evaluation and management of concussion.”

1.4 Concussion Knowledge and Awareness

When a concussion is sustained by an athlete, it is crucial that the injury is handled correctly, and the athlete is given the appropriate time to allow a full recovery before returning to play. To handle this injury correctly, all parties involved (coach, medical provider, athlete, etc.) must have the appropriate education. Athletes, especially those in high contact sports such as football, wrestling, and hockey are extremely susceptible to a hit to the head while competing in a game or a team practice. It is so important for an athlete to be able to recognize a concussion symptom, know the risks of sustaining a concussion and having the appropriate knowledge to be able to report a concussion. Zackary Lystedt’s story is a prime example of how important it is for individuals to recognize concussion symptoms, and act accordingly.

Highly talented adolescent athletes may have the chance to continue play in the National Collegiate Athletic Association (NCAA) at a college or university while receiving post-secondary education. These athletes have a high demand of both athletic and academic commitment. While these athletes are competing in their sport daily, and expected to excel in the classroom, it is extremely important to take care of their body, but more importantly their brain. Despite the importance of self-care, high school and college student-athletes remain one of the highest populations when it comes to unreported concussions.
CHAPTER TWO

Literature Review

2.1 Student-Athletes Underreporting Concussions

Sport related concussion diagnosis can often be challenging as all athletes experience different signs and symptoms and may not have the correct knowledge to be able to identify every possible symptom of a concussion. Some signs are more easily identified, such as the athlete failing to correctly answer Maddox questions within in the SCAT 5 (i.e. what month is it?, what is the date?), or if an athlete is stumbling on the field or ice. Symptoms, however, such as “feeling in a fog” or “not feeling right” can only be identified and reported by the athlete themselves. Because the most common ailments of concussion are headache and dizziness, a clinical diagnosis is highly dependent upon the patient’s self-report. Because of this, literature has suggested that approximately 50% of concussions amongst student-athletes go unreported. For example, in a previous study of 135 Division I NCAA athletes, 93.3% said they would hide a concussion symptom because they think they can “tough it out,” 90.4% said they did not want to be pulled out of a game or practice, and 85.2% said they would be afraid of losing future playing time. These athletes are prioritizing the current game, and not the long-term effects of a concussion. Table 1. shows a continued list of reasons for hiding symptoms as an NCAA Division I athlete.

Table1: Reason for Hiding Symptoms (n = 135)

<table>
<thead>
<tr>
<th>Reason</th>
<th>% Of Athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td>They think they CAN just “tough it out.”</td>
<td>93.3%</td>
</tr>
</tbody>
</table>
They don’t want to be pulled out of the game or practice. 90.4%
They are afraid they will lose future playing time. 85.2%
They don’t think it is serious enough. 85.2%
They don’t want to let down their teammates and coaches. 84.4%
They don’t know they have a concussion. 83.7%
They don’t want to appear weak 79.3%
They think they SHOULD just “tough it out.” 78.5%
They are afraid they will lose their spot on the team. 72.6%
They are afraid the coach will be mad. 64.4%
They are afraid their teammates will be mad. 57.0%
They think getting concussions is just part of the game. 40.7%
They don’t believe that their coaches want them to report it. 27.4%

These data are aligned with Kerr et al., who found that 78% of former NCAA Division I athletes did not want to leave the game or practice, 71.8% reported that they did not want to let their team down, 70.4% said they were not sure that it was a concussion, and 70.4% said they did not think a concussion was serious enough to report. Concussion reporting intentions are also associated with multiple factors such as the athlete’s perception of their coach’s communication of concussion, their own self-efficacy to be able to communicate a possible concussion, their concussion reporting attitudes, their expectations of positive outcomes of concussion reporting, and their perception of typical behavior from other surrounding athletes who reported a concussion. Overall, eight major themes have been identified when it comes to athletes’ experiences with sport related concussions and their decision on whether or not to report their
symptoms: optimism bias, invisibility of the injury, diagnostic barriers, a desire to play, external support and pressures, uncertainty of long-term prognosis, generational factors, and protection of future athletes.\textsuperscript{37} Of the athletes interviewed in this study, they underreported their concussion symptoms due to a misperceived risk, lack of education, and a struggle between internal and external pressures to play through an injury. These results are startling, as untreated, and unreported sport-related concussion during adolescence and early adulthood may have serious medical repercussions when it comes to affecting brain development and health.\textsuperscript{23,38}

\subsection*{2.2 Long Term Consequences of Sport Related Concussions}

\textit{Depressive disorders}

Psychological symptoms including irritability and anxiety are common in those with post-concussion syndrome,\textsuperscript{21} however, one long term consequence of concussions is developing depressive disorders.\textsuperscript{39} Retired athletes who sustained at least two concussions during their athletic career have a 1.5-fold risk of developing depression than their counterparts who never sustained a concussion.\textsuperscript{40} Sustaining three or more concussions during one’s athletic career increases the risk by 3-fold.

\textit{Neurodegenerative disease}

Having a history of head injuries has been linked with and considered a risk factor for multiple neurodegenerative diseases such as Alzheimer’s and Chronic Traumatic Encephalopathy (CTE).\textsuperscript{41} In a study of 3,439 American football players who played during the years 1959-1988, a 4-fold risk of mortality due to Alzheimer’s were observed, compared to the rates of the general population.\textsuperscript{42} Previous literature suggests that a genetic predisposition for
Alzheimer’s Disease is exacerbated by repeated concussions. Chronic Traumatic Encephalopathy is especially found in retired NFL football players and boxers, however, these data may be skewed as CTE studies have predominantly focused on retired NFL football players. Sometimes, symptoms of CTE are present while the athlete is still actively playing in their sport, however, these symptoms can often be misinterpreted and believed to be prolonged post-concussion syndrome.

2.3 Retiring From Sport

Concussions are amongst one of the top injuries as to why an athlete must retire earlier than expected from their sport. A majority (70-90%) of athletes tend to fully recover from a concussion within the first 10-14 days, however, in the case of recurrent concussions or lingering symptoms, one may be required to retire early. In a cohort of 350 athletes competing in the NCAA in one year, 98 concussions occurred amongst 95 student-athletes. Of these 95 athletes, 41 (43%) of the athletes had been previously diagnosed with a concussion. Eight athletes (10.4%) were forced to retire from their sport due to concussion-related issues. Six athletes (6.3%) experienced memory and/or concentration impairments lasting more than 1 year post concussion. The decision to retire from a sport is not solely based on the number of concussions alone, but rather on the athlete’s response to their concussion symptoms. This includes the athlete’s duration of symptoms and the ease of sustaining another concussion. With every concussion comes an increased vulnerability of one’s brain. It is suggested that athletes might be even more conservative with this decision, considering that the brains of young adults under 25 years of age are still developing.
2.4 Current Assessment Tools

The most common assessment tools used to diagnose a concussion are a vestibular ocular motor screen (VOMS), computerized neurocognitive tests, symptom scales, and working memory assessment.

**Sport concussion assessment tool 5 (SCAT 5)**

The SCAT 5 is a standardized evaluation tool used for individuals 13 and older who are suspected of having a concussion.\(^{11,52}\) This tool is used to test an athlete’s symptoms as well as their neurocognitive functions. This concussion evaluation tool is available for use in a medical provider’s office but is specifically designed for sideline use during a game or practice. Not only is this tool used to monitor an athlete’s concussion symptoms, but it may also be used to make decisions regarding an athletes return-to-play.\(^{52}\) Like the SCAT 5, the Concussion Symptom Inventory is an assessment tool used to track an athlete’s recovery, assist in medical management, and make decisions regarding return-to-play.\(^{53}\) It is a self-reporting concussion scale where the athlete is to rate their own concussion symptoms from 0-6 where 0 is absent and 6 is severe.\(^{52}\) Of course, a limitation to using the both of these assessment tools is having athletes underreport their symptoms to return-to-play earlier than they should.

**Vestibular ocular motor screen (VOMS)**

The VOMS has taken the place of the balance error scoring system, which was replaced due to the confounding associated with it.\(^{54}\) The VOMS takes 5-10 minutes to administer and was developed to test vestibular and ocular motor impairments through patient-reported symptoms. The test involves the patient following an object with their eyes through various
movements such as vertical and horizontal. Symptoms of headache, dizziness, nausea, and fogginess are assessed prior to the beginning of the assessment as a baseline as well as after every vestibular/ocular motor test.\textsuperscript{54} Sensitivity and specificity rates amongst the VOMS assessment tool are found to be 86\% and 90\% respectively.\textsuperscript{55}

**Automated neuropsychological assessment metrics (ANAM)**

The ANAM is a computer-based neuropsychological assessment tool used to test an athlete’s attention, concentration, reaction time, memory, processing speed, and decision making. This test is used to assess an athletes’ oculomotor and neurocognitive functions. Like the VOMS, it is critical for this assessment to be completed while the athlete is healthy to have a baseline score for each category. The immediate post-concussion assessment and cognitive testing tool (ImPACT) is another widely neuropsychological computer test used along with the ANAM, especially amongst athletes. The ImPACT test is most effective for comparing an athlete’s neurocognitive state before and after a concussion is sustained.\textsuperscript{56} The ImPACT tests verbal and visual memory, brain processing speed, and reaction time. Vincent et al., found that the sensitivity and specificity rates for the ANAM test were 71\% and 91\% respectively.\textsuperscript{57}

### 2.5 Treatment and Recovery from Sport-Related Concussion

Once an athlete sustains a SRC, he or she must immediately be removed from play.\textsuperscript{5} Once an initial assessment is made and the athlete is further assessed using the ANAM, VOMS, SCAT 5 and/or CSI, the athlete will likely be restricted from exertional activities such as attending class or participating in any physical activity until symptoms decrease in severity.\textsuperscript{5} It is recommended that an athlete rests for at least 1-2 days without any mental or physical exertion.\textsuperscript{4,5} Once
symptom free, athletes may begin a return-to-play protocol. McCrory et al. outlines the following steps for return to play:\(^4\)

1. **Stage 1:** Activity limited by symptoms: introduction of daily activities that do not provoke symptoms.

2. **Stage 2:** Light aerobic exercise of low intensity: elevation of heart rate above baseline activity with actions such as walking or cycling at a leisurely pace.

3. **Stage 3:** Exercise specific to sport: begin sport-specific movement such as running; contact strictly avoided.

4. **Stage 4:** Training without contact: resume drills with continued strict avoidance on contact with the goal of resuming coordination.

5. **Stage 5:** Resumed full contact practice: participate in practice drills including contact. Close monitoring is suggested.

6. **Stage 6:** Full return to play: resume normal participation in the sport.

Each stage must last for at least 24 hours before progressing onto the next stage. If the athlete’s symptoms return at any time during the stages, the athlete must take at least one day of rest before resuming the previous stage. This is designed to ensure athletes can pass all possible steps, not progress too quickly, and ensure concussion symptoms do not return.

### 2.6 Current Knowledge Gaps

To limit possible long term concussion risks, it is crucial for athletes to know, understand, and be able to identify all possible concussion symptoms. Current research indicates
there are knowledge gaps amongst athletic populations. Fedor and Gunstad conducted a study testing the knowledge of concussion symptoms between 382 Division I student-athletes and 230 non-athlete students at Kent State University. Of the eleven sport teams, football was the only group to score significantly higher for concussion knowledge versus the control group ($p = 0.003$). One limitation of this data were the different methods used to gather data from each group. Student-athletes were able to complete the ImPACT as part of their procedure, whereas controls did not. Other groups have tested concussion knowledge by comparing varsity student-athletes, recreational athletes, and non-athletes. Each participant was asked to identify whether a given symptom was concussion related. Only 83.3% of varsity athletes could correctly identify headache as a concussion symptom, whereas 91.1% of recreational athletes and 94.6% of non-athletes could do the same. Like previous research, the varsity athletes in this study did not have more knowledge of concussions and their symptoms, despite their higher risk.

2.7 Purpose of the Study

Not knowing about the risks of a concussion can lead to catastrophic injury, such as in the example with Zackery Lysetdt. Athletes have a previous history of withholding symptoms and letting their concussion symptoms go unreported and untreated. Unfortunately, being an athlete and more susceptible to a concussion does not mean better knowledge of concussion symptoms. Due to these concerning findings, the following study aims to validate a survey for NCAA student-athletes to measure their perception and knowledge of concussion symptoms. As a result of this work, a validated survey can be administered to future NCAA student-athletes to uncover knowledge gaps amongst teams and individuals, while also exposing dangerous misperceptions of concussions.
CHAPTER THREE
Methodology

3.1 Recruitment

Experts
A survey was sent out through email to 96 experts in the field of concussion. To be considered an expert, we looked for medical providers who have a history of treating and diagnosing a concussion, or members of the academic setting with a specialty in head trauma research. Experts that could have been included were nurse practitioners, physical therapists, athletic trainers, doctors, physician assistants, and academic faculty. The template that was used for the recruitment email can be found in appendix A. These experts were found through various Google searches using key words such as “concussion,” “concussion research,” “concussion expert,” and “concussion specialist.” Experts were also found internationally from cities throughout the USA and Canada.

Student-athletes
Along with the experts, we included a cohort of 60 NCAA student-athletes from the Rochester Institute of Technology (RIT). Their role was to complete an updated expert revised survey testing their knowledge and perception of concussions. To complete the survey, student participants must be 1) between 18 and 25 years of age and 2) a current NCAA athlete of any sport or division. RIT currently has sports that participate in two NCAA Divisions, Division I and Division III. Student-athletes in this cohort identified as one of these divisional athletes. Student-athletes were excluded from the study if they, 1) did not identify as a current NCAA athlete, 2) were currently recovering from a concussion, as symptoms may be present in their
mind or bias their point of view, and 3) anyone who reports a history of a single concussion that was diagnosed before 2012. The 4th edition of the Consensus Statement on Concussion in Sport, published in 2012, underwent significant changes from the 3rd edition in 2008. Drastic changes included outlining a return to play protocol for athletes to follow before returning to practice and/or competition. Also the criteria for on-field or sideline evaluation of acute concussion in the 3rd edition of this document allowed adults to immediately return to play on occasion, whereas the 4th edition states that no child, adolescent, or adult should return to play on the day of an injury. Therefore, any student-athlete who was diagnosed with a concussion consistent with 3rd edition criteria, prior to 2012, may possess a different understanding of concussion from the current definition, and will thus be excluded.

3.2 Instruments

*Expert review and scoring sheet*

Expert participants were asked to score the survey questions based on their relevance and clarity when it comes to testing the concussion knowledge and perceptions of college student-athletes. Experts were given a scoring sheet and were asked to review the survey and score each question with a 4-point Likert scale, where 4 = very relevant, 3 = relevant but needs some minor revisions, 2 = item needs revision, and 1 = not relevant. Using this Likert scale, experts scored each question separately for both relevancy and clarity. Based on the outcomes of expert scoring, questions were either eliminated, revised, or kept as-is. Experts were also given a chance to write a qualitative note for each question indicating their thoughts on how to improve the question or what they did not like about the question. The full list of survey questions can be found in appendix B, and the expert scoring sheet can be found in Table 2.
Table 2: Expert’s Scoring Sheet\textsuperscript{61}

<table>
<thead>
<tr>
<th>Question</th>
<th>Relevance</th>
<th>Clarity</th>
<th>Notes if applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 [not relevant]</td>
<td>1 [not relevant]</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2 [item needs some revision]</td>
<td>2 [item needs some revision]</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 [relevant but need minor revision]</td>
<td>3 [relevant but need minor revision]</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4 [very relevant]</td>
<td>5 [very relevant]</td>
<td></td>
</tr>
</tbody>
</table>

Revised survey for student-athlete participants
Once the survey was adjusted as needed, student-athlete participants were asked to complete the finalized Qualtrics survey of 27 questions (Qualtrics International Inc., Provo, UT, USA) focusing on demographic information, concussion history, perception of concussion, and knowledge of concussion symptoms. Before beginning the survey, student-athletes were required to read and provide consent. Participants had the choice to choose either “I consent” or “I do not consent.” The participant was not allowed to continue to the first question of the survey unless “I consent” was selected.

3.3 Data Analysis

Content validity

Content validity was determined by the viewpoints of the experts. A panel of 11 experts agreed to review our survey. Scores for each question were analyzed using the index of content validity (CVI). In particular, the Item-CVI (I-CVI) and the Scale-level-CVI (S-CVI) were used to measure content validity. To calculate the I-CVI, the number of experts that gave a question a Likert value of 3 or 4 was divided by the total number of experts who participated in the survey. Outcome scores from the I-CVI can range anywhere from 0.0 – 1.0. If the I-CVI is higher than 79 percent (0.79), the item is deemed relevant and is kept in the survey, as-is. If the item is between 79 -70 percent (0.79-0.70) the item is deemed relevant but needs revision. Revisions were made based on expert’s comments and suggestions. If the item scores lower than 70 percent (0.70), the item was eliminated. Table 3. Shows an example of I-CVI scoring.

Table 3: I-CVI Scoring Example

<table>
<thead>
<tr>
<th>Question</th>
<th>Relevant (Rating 3 or 4)</th>
<th>Not relevant (Rating 1 or 2)</th>
<th>Calculated I-CVIs</th>
<th>Interpretation</th>
</tr>
</thead>
</table>

The S-CVI was scored in two ways: the S-CVI Ave (S-CVI Average) and the S-CVI UA (S-CVI Universal Agreement). The S-CVI UA was scored using the number of items that attained a rating of 4 “very relevant” from all experts (i.e., unanimous relevance) divided by the total number of questions. For example, if eight questions scored a 1.0 on the I-CVI, then our S-CVI UA value would be 8/27, or 0.296. The S-CVI Ave was scored by taking the sum of the I-CVI scores divided by the total number of questions. For example, if our survey only contained three questions with I-CVI scores of 1.0, 0.66, and 0.66 respectively, then our S-CVI Ave value would be (1.0 + 0.66 + 0.66)/3, or 0.773.

Modified kappa statistic

Wynd et al. suggests that a kappa analysis should be used along with the I-CVI, as the I-CVI does not account for the possibility of inflated values. With Wynd’s suggestion, a modified kappa analysis was used to determine the degree of expert agreement based on chance. The probability of chance (Pc) and the kappa statistic (K) were calculated for each individual question in the survey using the following equations, respectively: 

\[ Pc = \frac{[N!/A!(N-A)!]}{N^A} \times 0.5^N, \]  

\[ K = (I-CVI - Pc)/(1 - Pc). \]

In these formulas, Pc = the probability of chance
agreement; N = total number of experts; and A = number of experts that agree the item is relevant (scoring the question a 3 or a 4). Kappa values above 0.74 are considered excellent agreement, values between 0.60 - 0.74 are considered good agreement, and values between 0.40 - 0.59 are considered fair agreement amongst the experts. Kappa values did not dictate whether a question was kept or eliminated.

Construct validity

Once our survey was completed by 67 student-athletes at RIT, another analysis took place to measure construct validity. The Cronbach’s alpha reliability test was used to determine the internal consistency between items in the scale. Cronbach’s alpha reliability coefficient normally ranges between 0 and 1, however, there is no lower limit to the coefficient. The closer Cronbach’s alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. The following rules have been cited for alpha value interpretation: > 0.9 = Excellent, > 0.8 = Good, > 0.7 = Acceptable, > 0.6 = Questionable, > 0.5 = Poor, and < 0.5 = Unacceptable. To be deemed significant, Cronbach’s alpha must be ≥ 0.70, given that our survey contained more than 10 items. Cronbach’s alpha was calculated using $a = (N \bar{c}) / (\bar{v} + (N - 1) \bar{c})$, however, this calculation was completed using SPSS statistical software (IBM Corp, Armonk NY, USA). Questions that required a qualitative written response were not incorporated into the alpha calculations. Cronbach’s calculations were used to measure two scales, knowledge-based questions, and perception-based questions.

Student-athlete Knowledge of Concussion
Previous studies have shown that knowledge gaps are present amongst collegiate athletes,\textsuperscript{58,59} therefore, we compared the responses to items 10, 20, 21, 22, 28, 32 (knowledge) and 11 (perception) between Division I and III participants. To score their answers, student-athletes received one point for every correct item they selected about concussions (e.g. correctly identifying a symptom), and were subtracted one point for every incorrect selection (e.g. incorrectly identifying proper care for concussion). Independent t-test was also conducted to for these questions to identify any differences between groups of athletes (level of significance: $p < 0.05$).
CHAPTER FOUR

Results

4.1 Demographics

Experts

Of the 106 experts who received the recruitment email, 15 agreed to participate in the study, however only 11 experts completed the expert scoring sheet. Of the 11 experts, $n = 4$ identified as a female and $n = 7$ identified as a male. Our cohort was comprised of one clinical neuropsychologist, two athletic trainers, one academic professional, two physician assistants, and five medical doctors. Experts all had different experiences with concussion and worked with different populations, such as athletes, non-athletes, children, adolescents, and adults.

Student-athletes

Seventy-one students began taking the survey, however, only 68 completed it in its entirety. From there, one student was eliminated from the survey due to not being a varsity student-athlete at RIT, and another was eliminated due to having a concussion prior to January 1st, 2012. Among the 66 student-athletes who qualified for the study, thirty-eight were female and twenty-eight were male. All 66 student-athletes identified as being 18-23 years old with a mean age of 19.56. No athletes identified as age 24 or older. Nine athletes identified as Division I, with the remaining 57 athletes identifying as Division III. Our sample showed distribution across all four undergraduate years, including fifth year or graduate students. Table 4. shows a full list of demographic information. When broken down by individual NCAA sport, each NCAA sport offered at RIT was represented, however, three participants did not indicate what
sport they played. These three participants were labelled as “unknown.” Table 5. shows a breakdown of participants by their individual sport.

**Table 4: Student-Athlete Participant Demographics**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
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<td>10</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Division</th>
<th>I</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class Year</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth Year</th>
<th>Fifth Year</th>
<th>Graduate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>27</td>
<td>11</td>
<td>13</td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**Table 5: Sport Distribution of Participating Student-Athletes**

<table>
<thead>
<tr>
<th>Sport</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheerleading</td>
<td>2</td>
</tr>
<tr>
<td>Cross Country</td>
<td>2</td>
</tr>
<tr>
<td>Men’s Baseball</td>
<td>3</td>
</tr>
<tr>
<td>Men’s Basketball</td>
<td>2</td>
</tr>
<tr>
<td>Men’s Ice Hockey*</td>
<td>3</td>
</tr>
<tr>
<td>Men’s Lacrosse</td>
<td>5</td>
</tr>
<tr>
<td>Men’s Rowing</td>
<td>1</td>
</tr>
</tbody>
</table>
SURVEY VALIDATION: CONCUSSIONS

Men’s Soccer 2
Swimming and Diving 6
Tennis 1
Track and Field 6
Women’s Basketball 5
Women’s Ice Hockey* 6
Women’s Lacrosse 2
Women’s Rowing 3
Women’s Soccer 6
Women’s Softball 4
Women’s Volleyball 1
Wrestling 3
Unknown 3

*Indicates a Division I sport

4.2 Results from Expert Panel on Validity

I-CVI Results

I-CVIs ranged from 0.636 to 1.00. A full list of I-CVI scores from expert review can be found in Table 6. There were two questions that were not answered by one expert, therefore, those two questions were scored as if there were only ten experts. Collectively, 14 of 28 (50%) questions scored a perfect 1 on the I-CVI. Twenty-six questions scored above >0.79, allowing them to remain in the study with no revision. One question scored between 0.71-0.79, indicating that this question should be kept, but required revision. Finally, one question scored < 0.70, causing it to be eliminated entirely from the survey.

Table 6: Expert Survey Review - Content Validity

<table>
<thead>
<tr>
<th>Question</th>
<th>I-CVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.90909091</td>
</tr>
<tr>
<td>2</td>
<td>0.90909091</td>
</tr>
<tr>
<td>3</td>
<td>0.81818182</td>
</tr>
</tbody>
</table>
### S-CVI Results

Our S-CVI/UA demonstrated moderate content validity. Calculation for universal agreement was as follows: $14/28 = S$-CVI of 0.5. The universal agreement is calculated by adding all the I-CVI scores equal to 1.00 (14 items) divided by 28. Our S-CVI/Ave for our survey was 0.93 which indicated high agreement amongst experts. The S-CVI/Ave was calculated as follows: $((0.9091x8)+(0.8182x2)+(1x14)+0.7273+(0.9x2)+0.6364)/28 = 0.93$

#### 4.3 Modified Kappa
A modified kappa was used to calculate the kappa statistics for each question. The modified Kappa calculations can be found in Table 7.

**Table 7: Kappa Calculations**

<table>
<thead>
<tr>
<th>Question</th>
<th>3 or 4 Rating</th>
<th>1 or 2 Rating</th>
<th>Pc</th>
<th>I-CVI</th>
<th>Kappa</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>1</td>
<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>2</td>
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<td>1</td>
<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>2</td>
<td>0.0269</td>
<td>0.8182</td>
<td>0.8132</td>
<td>Excellent</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
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<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>1</td>
<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>0</td>
<td>0.0005</td>
<td>1</td>
<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>0</td>
<td>0.0005</td>
<td>1</td>
<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>1</td>
<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>0</td>
<td>0.0005</td>
<td>1</td>
<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>0</td>
<td>0.0005</td>
<td>1</td>
<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>11</td>
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<td>1</td>
<td>1</td>
<td>Excellent</td>
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<td>12</td>
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<td>1</td>
<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>13</td>
<td>11</td>
<td>0</td>
<td>0.0005</td>
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<td>1</td>
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</tr>
<tr>
<td>14</td>
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<td>Excellent</td>
</tr>
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<td>15</td>
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<td>16</td>
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<td>1</td>
<td>Excellent</td>
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<td>17</td>
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<td>0.8132</td>
<td>Excellent</td>
</tr>
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</tr>
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<td>0.9</td>
<td>0.8972</td>
<td>Excellent</td>
</tr>
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<td>22</td>
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<td>1</td>
<td>0.0269</td>
<td>0.9</td>
<td>0.8972</td>
<td>Excellent</td>
</tr>
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<td>1</td>
<td>Excellent</td>
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<td>1</td>
<td>Excellent</td>
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</tr>
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<td>26</td>
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<td>0.0005</td>
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<td>1</td>
<td>Excellent</td>
</tr>
<tr>
<td>27</td>
<td>10</td>
<td>1</td>
<td>0.0054</td>
<td>0.9091</td>
<td>0.9086</td>
<td>Excellent</td>
</tr>
<tr>
<td>28</td>
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<td>4</td>
<td>0.1611</td>
<td>0.6364</td>
<td>0.5665</td>
<td>Fair</td>
</tr>
</tbody>
</table>

**4.4 Cronbach’s Alpha**
Eight items were used to test the internal consistency of knowledge-based questions (items 12-19), and three items were used to test the internal consistency of perception-based questions (Items 20, 23, and 25). Internal consistency was poor, to unacceptable, across both domains. Results of the analysis showed values of $\alpha = 0.291$ and $\alpha = 0.336$ for knowledge-based and perception-based questions respectively.

4.5 NCAA Division I vs. Division III Student-athletes

Knowledge Questions

We had a total of nine Division I athletes and 57 Division III athletes complete the survey. On average, Division I athletes were able to correctly identify (Item 10) 15.44 concussion symptoms while Division III athletes were able to correctly identify 14.89 concussion symptoms. This difference was not statistically significant ($p = 0.734$). To score this question, student-athletes received one point for every symptom they got right, minus one point for every incorrect symptom they chose. All nine Division I student-athletes correctly answered false when asked if a concussion only occurs if you lose consciousness, whereas only 53 of 57 Division III student athletes answered false ($p = 0.694$). When asked if sustaining a concussion ever requires someone to go to the hospital, six Division I athletes (67%) and 48 of 57 Division III athletes (84%) correctly said yes ($p = 0.263$). Athletes who answered yes were then asked what signs and symptoms would require someone to visit the hospital. Division I athletes were able to, on average, correctly identify 5.67 signs and symptoms, whereas Division III athletes were able to identify 6.52 signs and symptoms ($p = 0.294$). Eight Division I athletes (89%) and 52 Division III athletes (91%) were able to identify that concussions affect short term memory (p
All nine Division I athletes (100%) correctly responded “true” when asked if a concussion was life threatening, while 55 Division III athletes (96%) also said “true” \( (p = 0.575) \).

**Perception Questions**

For perception-based questions, eight Division I student athletes (89%) rated concussion as the most serious injury when it comes to interfering with daily life, with only 31 Division III student-athletes (54%) rating concussion as the same \( (p = 0.063) \). This question produced the largest differentiation between Division I and Division III student-athletes. Table 8. shows a list of all results between Division I and Division III student-athletes.

**Table 8: Division I vs. Division III Student-athletes**

<table>
<thead>
<tr>
<th>Item</th>
<th>Division I (N=9)</th>
<th>Division III (N=57)</th>
<th>Division I Scoring</th>
<th>Division III Scoring</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>9</td>
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<td>139</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>31</td>
<td>8</td>
<td>31</td>
<td>0.063</td>
</tr>
</tbody>
</table>

**4.6 Discussion**

Despite the significant increase in concussion studies published since the early 2000’s, there is currently no valid questionnaire to test NCAA athlete’s knowledge and perception of concussions. We aimed to validate a survey that can be used to test NCAA athletes’ perception and knowledge of concussion. The survey could be used to not only identify knowledge gaps
amongst athletes, but also point out dangerous misperceptions amongst student-athletes. Our main findings suggest that the survey has met the content validity criteria, however, the inter-item reliability for items within each scale was not considered acceptable. When comparing Division I to Division III student athletes, the two groups knowledge showed no significant difference when testing for knowledge. However, when testing for perception, the two groups showed a considerable differentiation.

**Content Validity**

The most common method for measuring content validity is calculating the I-CVI. Most papers report the I-CVI or the S-CVI but not both. This paper considered both the I-CVI and the S-CVI. Since the S-CVI/Ave is a less conservative method and may have a mean score that can be skewed by outliers, we decided to also include S-CVI/UA, as it is a more conservative analysis and gives a more strict representation of how the experts perceived the usefulness of the survey. I-CVIs from the expert’s scores ranged from 0.636 to 1.00 with 92.8% of values scoring greater than 0.79, indicating good content validity as I-CVI of $> 0.78$ is considered to be excellent. The minimum acceptable S-CVI/Ave and S-CVI/UA is considered to be any value higher than 0.90 and 0.80 respectively. In this study, the S-CVI/Ave = 0.93 which also indicates good internal consistency, and the S-CVI/UA = 0.5 which did not meet minimum requirements to be deemed acceptable. Still, these results are encouraging as other authors who used both the I-CVI and S-CVI were also able to produce strong evidence supporting content validity.

**Construct Validity**
Cronbach’s alpha results indicated the reliability between questions within a scale were not acceptable, meaning the items which were tested for both perception and knowledge were not closely related as a group. However, Cronbach’s alpha standards are said to be $\geq 0.70$, assuming a scale contains more than ten items.\textsuperscript{65} For our survey, both scales did not contain more than ten items and current research regrets to state acceptable values for this situation. Herman confirmed that while Cronbach’s alpha is the standard value reported for scale reliability, this value tends to underestimate the internal consistency of scales consisting of fewer than ten items.\textsuperscript{69} When there are fewer than ten items in the scale, Cronbach’s alpha values can be quite small, however, there is no definitive mention as to how small an alpha can be, and still hold significance. Sijtsma exclaims that alpha is not even a measure of internal consistency as one needs additional information to be able to interpret alpha, as alpha itself cannot be interpreted as a measure internal consistency.\textsuperscript{67} No other statistic has been recorded more often as a quality indicator of test scores than Cronbach’s alpha, nor has any other test gone through similar misunderstanding and confusion.\textsuperscript{67} As there is skepticism amongst values of Cronbach’s alpha, perhaps obtaining a low value should not be weighted so heavily amongst results of this study. There is still room for more research to be conducted when using this test, such as how to interpret the results with less than ten items. Current research suggests that to increase an alpha value, more items should be added to the survey.\textsuperscript{70} In a situation such as ours, research indicates that it may be better to calculate and report the mean inter-item correlation for each item.\textsuperscript{70} Future research should consider this method.

\textit{Methods for Improvement}
Future research needs to be conducted on how to increase the results displayed in Cronbach’s alpha. As of now, the common way to do this is to create more items for your survey, making each scale to be over ten items. Question formation can also influence internal consistency, in particular Cronbach’s alpha, when all questions are measured the same.\textsuperscript{25} For instance, all questions in the survey will be true or false questions or will be based on a 5-point Likert scale. In this way, all questions will be coded the exact same (i.e. positively, negatively, etc.). In our survey, questions were not all coded or worded the same, which in turn was likely detrimental to our alpha values. We used a mix of true and false questions, 5-point Likert scale questions as well as “select all that apply” questions. The current survey had numerous perception-based questions that required a written response by student-athlete participants. Because we were unable to code these questions properly and fairly, they were excluded from the Cronbach’s alpha calculation leaving only three possible questions to be incorporated. In the future, this survey, in particular, knowledge and perception-based items can be enhanced by modifying questions to all be coded and measured the exact same.

Previous literature suggest that multiple rounds of expert review has been found to be useful during survey validation.\textsuperscript{70} Zlateva et al., used experts to validate a survey, while questions were modified based on expert review. Experts reviewed a pool of items and rated them on a 5-point Likert scale for each item’s appropriateness, and ability to assess the indicated element of the conceptual model.\textsuperscript{70} This study used a consistent 5-point Likert scale for each item in their questionnaire which was previously shown to enhance the likelihood of obtaining a reliable Cronbach’s alpha.\textsuperscript{71} The study also used four rounds of expert review. In rounds one through three, questions were modified and reworded based on the qualitative input from experts. In the fourth round, experts commented on general format, language, response options, skip patterns
and definitions used. Adjustments were made following each round. In comparison to our study, experts were only able to score and view the survey once. Creating a method which allows experts to give opinions review questions more than once allows them to make decisions on items after looking over the survey a handful of times. This method allows experts to notice different things they may have previously missed as well as re-think questions based on thoughts and feelings they are having in the current day. On the contrary, this method enhances a researcher’s chances of losing expert participants, as asking requiring four follow-ups instead of will increase likelihood of loss to follow-up.

Division I vs. Division III Student-athletes

Research has not yet been conducted when it comes to testing concussion knowledge and perception between Division I and Division III athletes. The difference between these two divisions can mostly be seen when it comes to athletic care, athletic personnel, and athletic facilities. Division I student-athletes are thus thought to know more about concussion knowledge than those who participate in Division III athletes due to the amount of personnel and resources they have around them on any given day. In the current study, Division I and Division III athletes did show equal understanding and knowledge of concussion. Division I student athletes did slightly better when asked to correctly identify concussion symptomology (Division I, 15.44; Division III, 14.89), however, the perception of concussion is where the divisions widely differentiated. In the current study, when participants were asked whether sustaining a concussion effects short-term memory, only one Division I student-athlete said no, whereas five Division III athletes said no, however, because the sample size of Division III athletes heavily outnumbered Division I, Division III athletes displayed the higher percentage of participants who
answered the question correctly. To gain a relative understanding of Division I vs. Division III athletes, a similar number of participants in each category is required. In this way, percentages will be relative between groups.

4.7 Study Limitations

This survey had numerous perception-based questions that required a written response by student-athlete participants. Due to being unable to score these questions properly and fairly, they were excluded from the Cronbach’s alpha calculation leaving only three possible questions to be incorporated in the Cronbach’s alpha. This had a detrimental effect in our final Cronbach’s alpha calculations. Also, our experts came from multiple different backgrounds; however, we were not able to obtain data from healthcare professionals that could have qualified for the study such as, physical therapists or chiropractors. We were also only able recruit two experts who directly encounter student-athletes on a daily basis, athletic trainers. In all NCAA sports, athletic trainers are the primary provider responsible for treating and diagnosing a concussion, as well as removing athletes from competition. Future recruitment should target these individuals.

4.8 Study Strengths

We were able to get experts from multiple backgrounds with different experiences and disciplines. Their unique expertise made the data more generalizable and represented multiple different occupations. Among the experts who agreed to participate in the study (n=15), only four were lost to follow-up (27%). Next, our inclusion criteria of sustaining a concussion prior to January 1st, 2012, allowed us to include athletes who were diagnosed with a concussion using the same criteria.
4.9 Conclusion

The current study is a critical first step towards validating comprehensive and widespread tools to discover gaps amongst student-athlete’s knowledge and perceptions of concussions. Testing student-athletes knowledge will allow healthcare professionals and collegiate institutions to create plans as to how they will better educate their athletes and protect them from letting their concussions go unreported. Perfecting this survey can have a positive impact on the athletic population. The field of concussion is evolving, as society is becoming more aware of concussions and the consequences that may follow if handled incorrectly. Future studies should adjust the current questionnaire by adding more knowledge and perception questions that can be uniformly coded.
Appendix A: Recruitment email

Hello,

My name is Victoria Haywood. I am currently a graduate student in the Health and Well-being Management program at the Rochester Institute of Technology in Rochester, NY. As part of my degree requirement, I have chosen to conduct thesis research this semester in which I am seeking to validate a survey that can be used to test the knowledge and perception of concussion symptoms amongst NCAA collegiate varsity athletes.

Part of my research includes having a cohort examine my survey for content. This cohort will include both healthcare and academic professionals that have experience diagnosing, treating, and researching concussion. I am hopeful that you will join this cohort. If you are interested in taking part in this research, please reply to this email. A PDF of the survey and scoring sheet will be sent to you, accompanied by instructions. We would note that all data will be presented as de-identified group values, not individual responses.

If you have any questions, please feel free to email my thesis advisor Dr. Zachary Bevilacqua at *****@rit.edu. Thank you in advance for your time and participation.

Please note that this study has been approved by the RIT Human Subjects Research Office.
Appendix B: Full list of survey questions and consent form.

INTRODUCTION
You are invited to join a research study looking to understand the knowledge and perceptions of concussions among students and student-athletes at the Rochester Institute of Technology. The decision to join, or not to join this study, is completely voluntary.

WHAT IS INVOLVED IN THE STUDY?
The current study will ask questions regarding demographics, concussion history, and gather your knowledge of concussions. If you decide to participate in this study, select “I consent” below, and you will be taken to the survey. This survey will take you approximately 10 minutes or less to complete. We appreciate if you can answer all questions as completely as possible.

CONFIDENTIALITY
We will take the following steps to keep information about you confidential, and to protect it from unauthorized disclosure, tampering, or damage: The survey will not ask you any questions that may lead to an investigator to be able to identify you. All answers of the questionnaire will be kept on a password protected cloud-based system, through Qualtrics.

YOUR RIGHTS AS A RESEARCH PARTICIPANT
Participation in this study is voluntary. You have the right not to participate, or to leave the study at any time. Deciding not to participate or choosing to leave the study will not result in any penalty, and it will not harm your relationship with the investigator or university. To withdrawal from the study, simply close out the survey window, and your incomplete entry will be deleted from the investigation.

CONTACTS FOR QUESTIONS OR PROBLEMS?
Please email Dr. Zachary Bevilacqua at zwbihst@rit.edu if you have questions about the study or come across any problems.

Contact Heather Foti, Associate Director of the HSRO at (***) ***_**** or *****@rit.edu if you have any questions or concerns about your rights as a research participant.
Block 1

Q6
What is your sex?
- Male
- Female
- Prefer not to say

Q3
What is your current age?
[18]

Q2
What year of college/university are you currently in?
- 1st year
- 2nd year
- 3rd year
- 4th year
- 5th year
- Graduate student

Q4
Skip to
End of Survey if No is Selected
Are you an NCAA varsity student-athlete?
- Yes
- No
Q31
What NCAA Division do you currently compete in?
- Division I
- Division II
- Division III
- NJCAA

Q5
If Are you an NCAA varsity student-athlete? Yes is selected
Please indicate what NCAA sport you play.

[Women's Ice Hockey]

Block 2

Q7
Have you ever been diagnosed with a concussion by a qualified medical provider (e.g. physician, athletic trainer, physical therapist, physician assistant, nurse practitioner)?
- No
- Yes
Q8

Display this question

If you have ever been diagnosed with a concussion by a qualified medical provider (e.g. physician, a... Yes Is Selected

Skip to

End of Survey if 2011 Is Selected

Please indicate the year of your most recent concussion

2021

Q19

Display this question

If you have ever been diagnosed with a concussion by a qualified medical provider (e.g. physician, a... Yes Is Selected

Please indicate how many days you experienced symptoms from your most recent concussion

- < 7 days
- 7 - 14 days
- 15 - 30 days
- > 1 month
- I do not remember

Q9

How many concussions have you been diagnosed with by a medical provider, since January 1, 2012

0 1 2 3 4 5 6 7 8 9 10

Click to write Choice 1
Q26

How well would you rate your knowledge of the signs and symptoms of a concussion?

- Not knowledgeable at all
- Slightly knowledgeable
- Moderately knowledgeable
- Very knowledgeable
- Extremely knowledgeable
Q10

Please select all possible symptoms of a concussion that you know of:

- Headache
- Nose bleed
- Dizziness
- Blurred vision
- Loss of appetite
- Sensitivity to light
- Neck pain
- More emotional
- Irritability
- Sadness
- Insomnia
- Difficulty concentrating
- Balance problems
- Nausea or vomiting
- Dry eyes
- Pressure in the head
- Difficulty remembering
- Sensitivity to noise
- Feeling slowed down
- Feeling like "in a fog"
- Chest pain
- "Don't feel right"
- Being fatigued or having low energy
- Having a dry mouth
- Confusion
- Drowsiness
- Nervous or anxious
**Q16**

In your opinion, it is okay to continue to play or practice while showing symptoms of a concussion.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

**Q14**

In your opinion, how important is it to report a concussion to a medical provider?

- Not at all important
- Slightly important
- Moderately important
- Very important
- Extremely important

**Q28**

In your opinion, does sustaining a concussion ever require someone to go to the hospital?

- Yes
- No
Q20
Display this question

In your opinion, does sustaining a concussion ever require someone to go to the hospital? Yes is selected.

What signs or symptoms would require someone to visit the hospital following a concussion? (Please select all that apply)

- Neck pain or tenderness
- Chest pain
- Weakness and/or tingling in limbs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Losing control of bladder
- Vomiting
- Increasingly restless or agitated
- Double vision

Q21
True or False: Concussions affect short-term (immediate) memory.

- True
- False

Q22
True or False: You only have a concussion if you lose consciousness.

- True
- False

Q32
True or False: A concussion can be life threatening.

- True
- False
Q11
In your opinion, please rate the following injuries from most serious to least serious when it comes to interfering with daily function

<table>
<thead>
<tr>
<th>Injury</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislocated shoulder</td>
<td>1</td>
</tr>
<tr>
<td>Anterior Cruciate Ligament (ACL) tear</td>
<td>2</td>
</tr>
<tr>
<td>Broken arm</td>
<td>3</td>
</tr>
<tr>
<td>Concussion</td>
<td>4</td>
</tr>
<tr>
<td>Strained muscle</td>
<td>5</td>
</tr>
</tbody>
</table>

Q12
Display this question

If In your opinion, please rate the following injuries from most serious to least serious when it comes to interfering with daily function
Concussion Is Equal to 1

Please explain why you ranked a concussion as the most serious injury.

Q13
Display this question

If In your opinion, please rate the following injuries from most serious to least serious when it comes to interfering with daily function
Concussion Is Not Equal to 1

Please explain why you did not rank a concussion as the most serious injury.
Q23
Display this question
If Are you an NCAA varsity student-athlete? Yes is Selected

Have you ever continued to play through a practice or a game when you knew you were experiencing concussion symptoms?
- Yes
- No

Q29
Display this question
If Have you ever continued to play through a practice or a game when you knew you were experiencing... Yes is Selected

What was your rationale for continuing to play?

Q24

Would you hide concussion symptoms from a medical provider if you had an an upcoming championship game?
- Yes
- No

Q30
Display this question
If Would you hide concussion symptoms from a medical provider if you had an an upcoming championship... Yes is Selected

Please indicate why you would hide your symptoms in this situation.
Q25

If a fellow teammate was suffering from a concussion and asked you not to tell anyone, would you honor their request? Give a reason as to why or why not.
References

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SURVEY VALIDATION: CONCUSSIONS

Committee Approval

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