

Summer 8-2017

Concussion: Perceptions in Division II Collegiate Athletes

Brittany L. Billand

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CONCUSSION: PERCEPTIONS IN DIVISION II COLLEGIATE ATHLETES

A Thesis

Submitted to the School of Graduate Studies and Research

in Partial Fulfillment of the

Requirements for the Degree

Master of Education

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August 2017

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The purpose of this project was to provide an insight into college athletes' perceptions of concussion symptoms and the factors that influence an athlete's tendency to report concussion symptoms. A 21-question survey was distributed in-person to undergraduate and graduate student athletes at Indiana University of Pennsylvania. The survey examined their previous concussion history, their knowledge of concussions, and their concussion reporting tendencies. The results concluded that the Division II athletes at Indiana University of Pennsylvania need more information about the signs and symptoms of concussions, the dangers of sustaining multiple concussions, the dangers of letting concussions go untreated, and the importance of immediately reporting suspected concussions.

TABLE OF CONTENTS

Chapter		Page
1	INTRODUCTION	1
	Statement of the Problem	2
	Research Questions	2
	Hypotheses	2
	Limitations.....	3
	Assumptions	3
	Significance of the Study.....	4
2	REVIEW OF LITERATURE	5
	Concussion Prevalence.....	5
	Concussion Symptoms	6
	Acute Signs and Symptoms of Concussion.....	8
	Chronic Signs and Symptoms From Multiple Concussions.....	9
	Reporting Symptoms of Concussions	10
	Prevalence of Underreported Concussions.....	10
	Factors Influencing Concussion Reporting Tendencies	12
	Methods to Increase Concussion Reporting Rates	14
3	METHODS	16
	Participants	16
	Procedures	16
	Instrument.....	17
	Data Analysis	18
4	RESULTS OF DATA ANALYSIS	19
	Participants	19
	Analysis of the Variables.....	25
	Identifying Concussion Signs and Symptoms.....	25
	Factors Influencing Concussion Reporting Tendencies	28
	Rate of Underreported Concussions.....	29
	Underreported Concussions by Gender.....	31
	High-Risk Sports vs. Low-Risk Sports	32
	Athletes Lying About Concussion Symptoms	33
	Concussions Reported by Each Sport	36
	Summary	38
5	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	39

Chapter	Page
Summary	39
Conclusion/Discussion	39
Research Question One	40
Research Question Two.....	41
Research Question Three.....	42
Research Question Four	44
Recommendations	45
Recommendations for Athletic Departments	45
REFERENCES	48
APPENDICES	51
Appendix A- Student Athletes’ Perceptions of Concussion Survey	51
Appendix B- Site Approval Letter	54
Appendix C- Informed Consent Form.....	55
Appendix D- Permission to Use Instrument.....	56
Appendix E- CITI Training.....	57

LIST OF TABLES

Table		Page
1	Demographic Statistics of the Participants	21
2	Total Lifetime Concussions Sustained by Athletes.....	22
3	Concussion Prevalence by Sport.....	22
4	Post Hoc Test Showing Differences in Concussion Prevalence Between Sport	24
5	Knowledge of Concussion Signs/Symptoms	27
6	Concussion Reporting Tendencies by Sport	30
7	Reasons for Not Reporting Suspected Concussions	31
8	Concussions Reported by Gender	32
9	High-Risk vs. Low-Risk Sports	33
10	Post Hoc Test Showing Lies About Concussions Between Sports.....	35
11	One-Way ANOVA: Reported Concussions	36
12	Post Hoc Test Showing Reporting Tendencies Between Sports	37

LIST OF FIGURES

Figure		Page
1	Identifying most common sign of concussion	26
2	Factors influencing concussion reporting tendencies	29

CHAPTER 1

INTRODUCTION

Head injuries, including concussions, have become a serious concern in sports. It is very important to understand what concussions are and how they may affect each athlete individually. In a position statement written by Broglio and colleagues (2014), it was concluded that a concussion can be defined as a trauma-induced alteration in mental status that may or may not involve loss of consciousness. A concussion occurs when a force is applied directly, or indirectly, to the skull which causes the brain to rapidly accelerate and decelerate. “The sudden change in cerebral velocity elicits neuronal shearing, which produces changes in ionic balance and metabolism” (Broglio, et al., 2014).

Since the symptoms of a concussion can vary from mild to severe and can be different for each person, some athletes choose not to report the injury because they do not believe it is serious enough. Davies and Bird (2015), reported that 45% of the college athletes that were sampled did not report their suspected concussions. The top two reasons that the athletes in the Davies and Bird (2015) study failed to report their suspected concussions were that they, (1) “didn’t think it was serious enough” and they (2) “didn’t know it was a concussion”. One of the major complications of concussion treatment, is that since concussions are not visible injuries, medical professionals rely heavily on the athlete to self-report symptoms in order to make a diagnosis (Davies & Bird, 2015).

The purpose of this project is to provide an insight into college athletes' perceptions of concussion symptoms and the factors that influence an athlete's tendency to report concussion symptoms. The survey results will help Indiana University of Pennsylvania’s athletic department determine which sports teams might need more information about concussions, and which sports

teams are more likely to report their symptoms. The results of this survey will help to create a safer athletic environment for current and future athletes.

Statement of the Problem

The underreporting of concussion symptoms in athletes can be very dangerous to their health and prolong the recovery process. When concussion symptoms are not reported and the concussion goes undiagnosed, serious consequences can arise including persistent post-concussion symptoms, second-impact syndrome and chronic traumatic encephalopathy (Davies & Bird, 2015). The purpose of this study was to evaluate the perception of concussion symptoms in Division II college athletes, as well as the factors that influence the reporting of concussion symptoms.

Research Questions

1. Can Division II collegiate athletes correctly identify symptoms of concussions based on their previous knowledge of concussions?
2. What factors influence the reporting of suspected concussion symptoms in collegiate athletes at Indiana University of Pennsylvania?
3. Are Division II collegiate athletes underreporting suspected concussion symptoms more often than they report them?
4. Which Division II sports team reports their suspected concussion symptoms the most?
And the least?

Hypotheses

The following hypotheses will be addressed during the study:

1. A lack of knowledge of concussion symptoms will be the number one reason that student-athletes did not report their suspected concussion symptoms.

2. Division II collegiate athletes are underreporting suspected concussion symptoms more often than they are reporting them.
3. Female student-athletes will have a higher rate of reporting suspected concussion symptoms than male student-athletes.
4. The sport that the athlete plays will have an influence on the decision to report suspected concussion symptoms.
5. Student-athletes involved in high-risk sports will report suspected concussion symptoms less often than athletes in low-risk sports.

Limitations

This study was limited by the following:

1. The accuracy of the student-athletes' responses to the survey questions cannot be validated as truthful.
2. The football team had the largest number of athletes when compared to every other team so the results are heavily skewed towards male athletes. This accurately represents the athletic population at Indiana University of Pennsylvania.
3. The data were only gathered from one Division II university, which was Indiana University of Pennsylvania.

Assumptions

The following assumption guided this study:

1. The athletes answered the survey with honesty and to the best of their ability.
2. The survey used is appropriate for the target population

Significance of the Study

Previous research has shown that the underreporting of concussion symptoms is a common occurrence in today's society. In a study conducted by (Davies & Bird, 2015), 45% of the studied collegiate athletes did not report their suspected concussion symptoms and 60% of those athletes did not report the suspected concussion of a teammate. The underreporting of suspected concussion symptoms can be very dangerous to an athlete's health. Since concussions are not visible injuries, medical professionals rely heavily on the athlete to self-report symptoms in order to make an accurate diagnosis (Davies & Bird, 2015).

This study will provide an insight into athletes' perceptions of concussion symptoms and the factors that influence an athlete's tendency to report concussion symptoms. Since medical professionals rely so heavily on self-reporting, it is important for them to understand the factors that affect the reporting of suspected concussion symptoms. It is also important for medical professionals to understand the extent to which the athletes understand concussion information and what the associated symptoms are. The results from the study will help the Indiana University of Pennsylvania's athletic department determine which teams report concussion symptoms more than others, and which teams may need more information about concussions and the associated symptoms and dangers.

CHAPTER 2

REVIEW OF LITERATURE

A concussion is a trauma-induced alteration in mental status that may or may not involve loss of consciousness (Broglia, et al., 2014). Concussions occur when the skull is impacted, and the brain rapidly accelerates and decelerates. A concussion can happen when the skull is hit directly. It can also occur when an athlete suffers a hit to the body, which then causes the brain to accelerate and decelerate. The associated signs and symptoms of a concussion will be different for each athlete, which is why it is important to understand what concussions are and how they occur. Due to the wide variety of symptoms, differences in injury severity, and reporting tendencies, concussions remain one of the most complex injuries that medical professionals face (Broglia, et al., 2014).

Concussion Prevalence

Head injuries, including concussions, are very common in sport and recreation. Snedden and colleagues (2013), found that concussions [have] been estimated to occur in 1.6–3.8 million athletes in the United States each year, with the most affected being youth ages 10-19. Athletes take hundreds of hits, which slightly transmit forces to the skull each season (Baugh et. al., 2014). Even though these hits could seem minor, each time an athlete's brain is jarred, they have a higher risk for developing a concussion. It was found that approximately 65% of all emergency room visits for children ages 5-18 were due to sport or recreation related brain injuries, including concussions (Baugh, et al., 2014). In a similar study, Miyashita and colleagues (2014) concluded that sports are the leading cause of traumatic brain injuries in individuals between 15-24 years old, including concussions, and these injuries make up approximately 15% of all high school

sport injuries. There is evidence that concussions are very prevalent in sport, but the actual numbers remain unknown due to being underreported and/or underdiagnosed.

Most concussion research focuses on high school, college, and professional athletes, but young children can suffer concussions as well. According to McBride (2012), it is estimated that 3.5 million children, as young as seven, are sustaining high impacts to their skull, which is concerning when considering their developing brains. In a similar study, conducted by Daniel, Rowson, and Duma (2012), accelerometers were placed inside the helmets of seven youth football players. It was found that these young children endured impacts at the same level that are suffered by college players, averaging 107 impacts per player (Daniel, Rowson and Duma, 2012). High impact hits in young children are concerning because these children do not have the developed neck and chest muscles that adults have. Those muscles are necessary to help stabilize the head and protect from injuries caused by rapid acceleration. According to McBride (2012), even a small hit to the head can give children problems for months afterwards and up to 15% of the children who lose consciousness end up having cognitive problems months after the incident. That is why it is important to take as many preventative measures against sustaining concussions as possible.

Concussion Symptoms

Concussions usually present with a rapid onset of neurological impairments which typically resolve themselves spontaneously, though some symptoms could develop hours after impact and linger for days following the injury (Davies and Bird, 2015). According to McCrory, et al., (2013), approximately 80-90% of concussions will resolve themselves within 7-10 days, but the length of recovery may be longer in children and adolescents. Concussions can occur during almost any sport or recreational activity, but the sport that is usually associated with

concussions is football, which accounts for approximately 50% of all concussions (Miyashita, et al., 2014). Women's soccer typically has the second highest rate of concussions, followed by men's soccer. The amount of concussions sustained will depend on the athletes and the intensity of the game (Miyashita, et al., 2014).

It is very important for an athlete to understand the varying signs and symptoms of a concussion. As McBride (2012) mentions, unlike a broken bone, concussions do not always present outward symptoms, even if the internal damage to the brain is severe. When an athlete sustains a concussion, they will experience acute symptoms, and in some cases the athlete can have chronic, long-term symptoms. The rapid shaking of the brain causes the brain cells to become depolarized, and during the recovery process these cells are trying to reestablish their equilibrium (McBride, 2012). Since these cells could take hours, weeks, or even months to reestablish their equilibrium, it is hard to pinpoint exactly how long the concussion recovery process will take. In some cases, the brain cells remain depolarized forever (McBride, 2012). According to McCrory and colleagues (2013), an initial period of rest in the acute symptomatic period, roughly 24 to 48 hours after sustaining a concussion, will be of benefit to the athlete's recovery.

As previously discussed, signs, symptoms, and severity of a concussion can vary from athlete to athlete. In a study conducted by Baugh et al (2014), it was confirmed that concussions from contact sports and other sources can lead to negative biomedical, social, and behavioral outcomes. These include but are not limited to sleep disturbances, difficulty concentrating, depression, cognitive deficits, difficulty remembering certain things, and in some cases, suicidal ideation. The symptoms that an athlete can experience after a concussion will depend on the resilience of the athlete, and the severity of the injury.

Acute Signs and Symptoms of Concussion

The acute stages of a concussion will usually present with a rapid onset of short-lived neurological impairments which typically resolve themselves spontaneously. Davies and Bird (2015) concluded that there are four main categories that concussion symptoms can be placed into which include: cognitive, physical, emotional, and sleep-related. According to Nelson, et al., (2013), some of the acute cognitive symptoms of a concussion include a lack of awareness of surroundings, poor attention and concentration, general disorientation, confusion, and memory deficits. The cognitive domains that are most often affected by concussions include attention and concentration, processing speed, and memory. The acute physical domain of symptoms may include but is not limited to loss of consciousness, headache, dizziness, nausea/vomiting, light-headedness, fatigability, ringing in the ears, difficulty focusing vision, intolerance to bright lights or loud noises, delayed verbal/motor responses, and unusual incoordination.

Although some athletes can lose consciousness immediately after sustaining a hit to the head, a loss of consciousness is not considered a defining characteristic of a concussion. In one of the largest concussion studies ever conducted, which examined 1,003 football concussion cases across different levels of play, it was concluded that only 8.9% of those concussions involved a loss of consciousness (Nelson, Janecek, and McCrea, 2013).

The possible emotional symptoms of a concussion include: anxiety, depression, irritability, and a low frustration tolerance, which should all resolve themselves within seven to fourteen days (Edwards and Bodle, 2014). Following a concussion, an athlete could also experience disturbances in academics and their normal sleeping habits (Nelson, Janecek, and McCrea, 2013). When an athlete is concussed, even a simple activity such as reading or trying to

focus on a chalkboard, can cause symptoms to flare up, so it is important that academics are considered when creating a comprehensive recovery plan (Davies and Bird, 2015).

Chronic Signs and Symptoms From Multiple Concussions

There are many acute symptoms that an athlete could experience following a concussion. It is important that athletes know and understand these symptoms because medical professionals rely heavily on athletes to self-report their symptoms in order to diagnose a concussion. Depending on the individual athlete, the acute concussion symptoms that are experienced can sometimes linger and become chronic symptoms. It is important that athletes have the ability to identify and report their symptoms, because there are many dangers associated with leaving symptoms untreated and sustaining multiple concussions. It has been assumed that when an athlete sustains multiple concussions, they are at risk of developing more serious post-concussion problems, including Second Impact Syndrome (SIS) and Chronic Traumatic Encephalopathy (CTE) (Edwards and Bodle, 2014).

After an athlete sustains a concussion, their brain is in a vulnerable state due to the brain cells becoming depolarized. As defined by Edwards and Bodle (2014), Second Impact Syndrome (SIS) can be fatal and occurs when an athlete suffers multiple concussions while the brain is in a vulnerable state of healing. Death from SIS is caused by massive cerebral edema, impaired cerebral autoregulation, and herniation of the brain through the bottom of the skull (Edwards and Bodle, 2014). Since SIS can be fatal, all coaches, athletes, and medical personnel need to understand the importance of letting the brain fully recover after a concussion before returning to play. Once an athlete sustains a concussion, they are up to four times as likely to sustain a second concussion (McBride, 2012).

Another dangerous consequence of sustaining multiple concussions is the possibility of developing Chronic Traumatic Encephalopathy (CTE). CTE can be defined as a neurodegenerative process that occurs after sustaining multiple concussions and is characterized by an early onset of cognitive decline and psychiatric disturbances (Edwards and Bodle, 2014). Even after sustaining multiple head impacts, CTE could still take years to develop, and some of the more common symptoms associated with this condition include: difficulty with memory, poor impulse control, depression, dementia, and suicidal behaviors. Previous research studies have also shown that CTE can cause physical anatomic changes to the brain such as: decreased brain weight, atrophy of the frontal and temporal lobes, a thinning of the corpus callosum, and an enlargement of the ventricles (Edwards and Bodle, 2014). If an athlete chooses not to report their suspected concussion, they will be at risk for further brain injury, and potentially developing SIS or CTE.

Reporting Symptoms of Concussions

Concussions are a very serious injury in sports, and the consequences of sustaining multiple concussions and/or leaving symptoms untreated can be very severe. Previous studies have shown that the underreporting of concussion symptoms is a common occurrence in sports. It has been estimated that between 30% and 50% of suspected concussions go unreported by athletes (Asken, et al., 2016). Since concussions are not visible injuries, medical professionals rely heavily on the athlete to self-report symptoms in order to make an accurate diagnosis (Davies & Bird, 2015).

Prevalence of Underreported Concussions

In a study conducted by Davies & Bird (2015), 45% of the collegiate athletes did not report their suspected concussion symptoms and 60% of those athletes did not report the

suspected concussion of a teammate. The top two reasons that athletes failed to report their suspected concussions were that they (1) did not think it was serious enough, and (2) did not know it was a concussion (Davies & Bird, 2015). This shows that athletes are most likely unaware of the serious consequences that can arise from leaving concussions untreated. Some of these athletes might need more information about the different concussion symptoms and how/where to seek help when they think they have a concussion.

It was also found that only 47.3% of high school football players had reported their suspected concussion to someone that they trust (Davies and Bird, 2015). According to previous research studies, it was found that 53% of high school football players did not report their concussion symptoms (Miyashita, et al., 2014). This study also found that 50% of their participants would return to play following a concussion without consent from a physician, and 22% of those athletes would return to play against the physician's orders (Miyashita, et al., 2014). This lack of reporting is a major concern because delayed treatment can lead to more severe or permanent brain damage.

Miyashita and colleagues (2014) conducted a study on concussion perceptions in high school athletes and found that 65.4% of athletes reported that they have had their "bell rung", yet only 38% of them acknowledged having a past medical history of concussion. This proves that some concussions are going unreported. It was concluded that the most common factors that cause an underreporting of suspected concussions are a lack of knowledge, the failure to recognize concussion signs and symptoms, and the failure to receive medical attention (Miyashita, et al., 2014). It was also concluded that 50.9% of the surveyed athletes stated "yes" when asked if the importance of a game should be considered when making return to play decisions following a concussion (Miyashita, et al., 2014). This statistic shows that the majority

of the athletes surveyed would be willing to lie about their concussion symptoms in order to participate in an important game or event.

Underreporting concussion symptoms can be dangerous to the athlete's health and prolong the recovery process. Previous research has concluded that "the delayed reporting of concussion symptoms was associated with a recovery time almost 5 days longer than the recovery time of athletes who immediately reported their symptoms. Athletes who do not immediately report suspected concussion symptoms and continue to participate in activity can potentially further injure their brain and are at risk for a longer recovery than those athletes who report immediately" (Asken, et al., 2016). In order to have a shorter recovery time and ensure the health of the athlete, it is important that athletes report their symptoms immediately and are removed from activity immediately.

Factors Influencing Concussion Reporting Tendencies

Concussions have become a significant public health concern over the last decade and the underreporting of suspected concussion symptoms is still a major issue. There are many factors that can influence the reporting of concussion symptoms including their perceived support from coaches and teammates to report their symptoms. If an athlete is in an environment that does not support the reporting of injuries or an environment that makes athletes seem "weak" for being injured, the athlete will most likely hide their symptoms and injuries. Kroshus, et al., (2015), concluded that 26% of athletes reported feeling pressure from either their teammates, coaches, parents, or fans after sustaining a head injury. Furthermore, it was found that of all participants studied, 13.26% felt pressure to continue playing from teammates, 13.68% felt pressure from their coach, 9.42% felt pressure from their parents and 8.12% felt pressure from the fans. It was also found that athletes who felt pressure from all four sources were more likely to continue

playing while experiencing concussion related symptoms. Coaches and teammates can relieve this pressure from fellow athletes by being more open about concussion safety and awareness. Register-Mihalik, et al. (2013) concluded that attitude towards concussions and knowledge of signs and symptoms influence concussion reporting behaviors in high school athletes.

Another factor that could influence an athlete's tendencies to report suspected concussion symptoms is the athlete's knowledge of concussions and the associated symptoms. The top two reasons that athletes failed to report their suspected concussions in study were that they (1) did not think it was serious enough, and (2) did not know it was a concussion (Davies & Bird, 2015). This shows that some athletes would benefit from more information about concussions. In a similar research study, it was found that 70.2% of players with concussions did not believe the injury required medical attention; 36.5% did not want to be suspended from the game; and 14.9% were unaware that they had sustained a concussion (Register-Mihalik, et al., 2013). The underreporting of concussions is very serious because these athletes are putting themselves at risk for developing SIS, which can be fatal, and other serious long-term consequences.

A recent study concluded that "formally educating athletes on proper concussion management may assist in improving reporting and decreasing the total number of concussions sustained by athletes each season" (Miyashita, et al., 2014). Athletes were given a concussion perception survey before and after an informative lecture about concussions. After the lecture, the survey results showed that 67.4% of athletes answered that they would be more likely to report suspected concussions in the future (Miyashita, et al., 2014). This study shows that some athletes are not purposefully hiding their concussions, they just did not fully understand the symptoms to look for and when to report their suspected injury. In a similar study, 60% of the athletes surveyed knew of a teammate with a suspected concussion but they did not report it

because an athletic trainer witnessed the incident, and they did not feel the need to report the concussion themselves (Davies and Bird, 2015). It is important that athletes report all suspected concussions, even if they think someone saw the incident, because there are times when the athletic trainer is looking in the same direction, but at a different player, and misses the incident.

Methods to Increase Concussion Reporting Rates

A few solutions have been suggested for the problem of underreporting concussion symptoms. One solution is to make it a law in all states that the athletes must directly receive information about concussions and confirm that they have received the information (Baugh, Kroshus, Bourlas & Perry, 2014). It is currently a law in all states except Mississippi, New Hampshire, Colorado and Connecticut. These states require that the parents receive concussion information but, the law includes nothing about the athletes receiving concussion information (Baugh, Kroshus, Bourlas & Perry, 2014). A second solution would be to make concussion reporting forms less open-ended and easier for athletes to understand, especially if they are unsure of the symptoms of a concussion. Recent research by Fedor and Gunstad (2014), indicates that athletes are likely to report fewer symptoms of concussion when asked in an open-ended format when compared to a structured questionnaire containing the suspected symptoms.

A possible solution to increase concussion reporting would be for the NCAA to establish stricter rules in regards to the distribution of concussion information. In a recent study, it was found that only eight of the ten schools included in the study required that athletes acknowledge that they have received concussion-related information and that they are responsible for reporting concussion symptoms, and approximately 40% of the athletes who provided acknowledgement, did not recall having done so (Baugh, Kroshus, Bourlas & Perry, 2014). This suggests that athletes are not retaining, understanding and/or receiving the NCAA's concussion information.

This lack of knowledge of concussion symptoms was one of the main factors that led to the underreporting of concussion symptoms in the study conducted by Davies & Bird (2015).

In conclusion, more research needs to be done on the prevalence of underreported concussions in sports, and the factors that could influence an athlete's tendency to report suspected concussion symptoms. "Formally educating athletes on proper concussion management may assist in improving reporting and decreasing the total number of concussions sustained by athletes each season" (Miyashita, et al., 2014). The purpose of this study was to evaluate the perception of concussion symptoms in Division II college athletes, as well as the factors that influence the reporting of concussion symptoms.

CHAPTER 3

METHODS

This research study took place in the spring semester of 2017 at Indiana University of Pennsylvania (IUP). This project was a descriptive design with quantitative properties. It was quantitative because the data were analyzed through numerical comparisons, using the SPSS Statistics 24 program. The subjects for this study were comprised of a convenience sample of student athletes from one Division II University in rural western Pennsylvania. The average age range of the student athletes was from 18-23 years old. Data were comprised from information from both male and female student athletes. This study did not take race or socioeconomic status into consideration. The population size for this project includes an estimated three hundred and fifty student athletes.

Participants

All NCAA Division II athletes at Indiana University of Pennsylvania were asked to participate in the study. To be included the participants had to be a NCAA division II college athlete at the Indiana University of Pennsylvania, and willing to participate in a comprehensive anonymous survey titled, Student Athletes' Perceptions of Concussion Survey (Appendix A). Any athletes who were not present during the day of the survey distribution, were excluded from the study. There are approximately 350 student-athletes at Indiana University of Pennsylvania. There are eight men's collegiate teams and ten women's collegiate teams.

Procedures

After Institutional Review Board research approval, and site approval from the Indiana University of Pennsylvania's Athletic Department (Appendix B), the participants were recruited. This research study took place in various rooms in the Memorial Field House at Indiana

University of Pennsylvania. In order to recruit the participants, the primary researcher contacted all athletic coaches at Indiana University of Pennsylvania through university email. At the end of scheduled meeting times for the collegiate athletic teams, the primary researcher held informational sessions about the proposed study with all of the athletes in attendance. These sessions included the overview of the study, eligibility requirements, data collection procedures, potential risks, and potential benefits. A consent form for the athletes containing information about the research study was distributed at the meeting (Appendix C). Once the willing number of participants were determined, data collection began by asking the willing participants to complete the Student Athletes' Perceptions of Concussion survey. Completion of this survey took the athletes approximately 10 minutes. The survey was distributed in-person, with hopes of a higher completion rate than a survey was distributed online. This study was conducted at the end of a scheduled team meeting time, so the athletes who did not want to participate could simply leave the room. In order to keep confidentiality, the coaches were not present while the participants completed the survey. There were no penalties for the athletes who chose not to participate in the survey and the participants were allowed to stop taking the survey at any time. The athletes were instructed not to put any personal information on the survey since it was anonymous. If an athlete returned a completed survey, that served as their informed consent to participate in the study.

Instrument

This project used the *Student Athlete's Perceptions of Concussion* survey (Miyashita et al., 2014). This instrument was developed to measure concussion reporting tendencies and perceptions among student-athletes. Demographic information was also collected as part of this

study (i.e. gender, sport(s) played, age, etc.) to better answer address the research question established for this project. Permission was granted to use this instrument (Appendix D).

The developers of this instrument (Miyashita et al., 2014) determined the construct validity by providing the survey to two different groups for comparison analysis: (1) a group of college students with no formalized education in concussion injuries and, (2) a group of senior-level athletic training students with formalized concussion education and training. The survey scores were compared between the two groups using a t-test. The senior-level athletic training students had a significantly higher mean rank ($t = 19, p = .000$). The reliability of the instrument was assessed using a test-retest Pearson coefficient. A group of 15 college students participating in an introductory human movement science course were asked to complete the survey and were asked to take the same survey 12 days later. The educational lecture was not given to this population; however, students did score slightly higher on the retest (7.1) compared with the original test (6.9). There was still a high correlation between testing dates ($r = 0.656$).

Data Analysis

Findings from this study were based on results from the anonymous, voluntary survey. For the data analysis, the primary researcher utilized the SPSS Statistics 24 program. Descriptive statistics and paired t-tests were utilized to analyze the responses from student athletes to examine mean differences between the sports teams. Tabular frequencies were also used to express of various outcomes within this sample. Bar graphs were utilized to graph student athletes' reporting tendencies between the different sports teams. Individual results were combined and only the group results were analyzed and reported. In accordance with federal regulations, the data will remain confidential and in a secure location for 3 years from the completion of the project.

CHAPTER 4

RESULTS OF DATA ANALYSIS

Participants

The data from this study was collected from student athletes at Indiana University of Pennsylvania. To be included in the study, the participants had to be a NCAA division II college athlete at the Indiana University of Pennsylvania, and willing to participate in a comprehensive anonymous survey. Any athletes who were not present during the day of the survey distribution, were excluded from the study. Completion of the anonymous survey served as the informed consent of the athlete to participate in this research study. There are approximately 350 student-athletes at Indiana University of Pennsylvania, and together they make up eight men's collegiate teams and ten women's collegiate teams. The average age range of the athletes who participated in this study was 18-23 years old. The data were comprised from information from both male and female student athletes. This study did not take race or socioeconomic status into consideration. The survey was distributed to the athletes in-person.

Of the approximate 350 student athletes at Indiana University of Pennsylvania, a total of 125 athletes (35.7%) completed the survey. This survey was distributed in-person with hopes of getting a higher response rate than an online survey. The survey was distributed to each sports team individually, after one of their scheduled meetings. The athletes were informed that they did not have to participate if they did not want to, and that no penalties would arise from them choosing not to participate. All student athletes met the participation qualifications as the survey was only sent to student athletes at Indiana University of Pennsylvania. Of the 125 athletes who participated in the study, 73 of the participants were male and 52 were female, as shown in Table 1. Table 1 also displays the age, academic year in college, and sport(s) for each participant.

The age range of the participants was 18 - 22+, with the majority of the participants being twenty years old (33.6%). Most of the participants were academically sophomores (36%), followed by juniors (28%), freshman (23.2%), seniors (11.2%) and the 5th year students (1.6%). Of the 125 participants, only two were 5th year students. Sixty-two of the participants, making up about 50% of the sample size, participated in football at Indiana University of Pennsylvania. The remaining athletes either participated in women's soccer (16%), volleyball (10.4%), women's basketball (9.6%), or more than one sport (14.4%). All of the athletes who listed dual sport, identified track and field, and cross country as their sports (100%).

Table 1

Demographic Statistics of the Participants

		Frequency	Percentage
Age	18	12	9.6
	19	32	25.6
	20	42	33.6
	21	28	22.4
	22+	11	8.8
Gender	Male	73	58.4
	Female	52	41.6
Year in College	Freshman	29	23.2
	Sophomore	45	36.0
	Junior	35	28.0
	Senior	14	11.2
	5 th Year Student	2	1.6
Sport	Basketball	12	9.6
	Soccer	20	16.0
	Volleyball	13	10.4
	Football	62	49.6
	Dual Sport	18	14.4

As part of this study, the occurrences of sustained concussions were documented from the participants. Table 2 displays the total number of previous concussions sustained by each athlete. This table outlines if an athlete has ever sustained a concussion, and if so, how many previous concussions they have sustained.

Table 2

Total Lifetime Concussions Sustained by Athletes

	Frequency	Percent
0	53	42.4
1	36	28.8
Number of Concussions	2	16.8
	3	4.0
	4+	8.0

Table 3 displays the total number of sustained concussions grouped by each sport. The sport with the highest occurrence of concussion was soccer (80%), followed by football (69.3%), volleyball (46.1%), basketball (41.6%), and dual sports (11.1%). The football team had the highest number of athletes who have never sustained a concussion ($n = 19$), and soccer had the fewest ($n = 4$). Both the football ($n = 8$) and volleyball ($n = 2$) teams had athletes who reported sustaining four or more concussions in their lifetime.

Table 3

Concussion Prevalence by Sport

	Number of Concussions					Total
	0	1	2	3	4+	
Basketball	7 (59%)	4 (33%)	1 (8%)	0	0	12
Soccer	4 (20%)	6 (30%)	6 (30%)	4 (20%)	0	20
Volleyball	7 (54%)	4 (31%)	0	0	2 (15%)	13
Football	19 (30%)	21 (34%)	13 (21%)	1 (2%)	8 (13%)	62
Dual Sport	16 (88%)	1 (6%)	1 (6%)	0	0	18

Table 3 showed differences in the total amount of concussions sustained based on each sport. To determine if these differences were significant, an analysis of variance (ANOVA) was computed. It was determined that significant differences did exist between selected sports. Therefore, a Post-Hoc Test (Tukey HSD) test was ran to determine where the significance occurred. As displayed in Table 4, the results showed that the dual-sport athletes sustained the least amount of concussions. Furthermore, it was determined that the soccer athletes sustained significantly more concussions than dual sport athletes; with a mean difference of 1.333 ($p=.004$). The football athletes also sustained significantly more concussions than dual sport athletes; with a mean difference of 1.156 ($p=.002$). There were no significant differences in the total number of concussions sustained between the football and soccer athletes.

Table 4

Post Hoc Test Showing Differences in Concussion Prevalence Between Sport

		Mean Difference (p)
Basketball	Soccer	-1.000 (.124)
	Volleyball	-.423 (.887)
	Football	-.823 (.158)
	Dual Sport	.333 (.935)
Soccer	Basketball	1.000 (.124)
	Volleyball	.577 (.619)
	Football	.177 (.974)
	Dual Sport	1.333* (.004)
Volleyball	Basketball	.423 (.887)
	Soccer	-.577 (.619)
	Football	-.400 (.782)
	Dual Sport	.756 (.369)
Football	Basketball	.823 (.158)
	Soccer	-.177 (.974)
	Volleyball	.400 (.782)
	Dual Sport	1.156* (.002)
Dual Sport	Basketball	-.333 (.935)
	Soccer	-1.333* (.004)
	Volleyball	-.756 (.369)
	Football	-1.156* (.002)

Note The mean difference is significant at the 0.05 level*

Analysis of the Variables

The variables that were analyzed in this study include the athletes' ability to identify concussion signs/symptoms; the different factors that influence concussion reporting tendencies; the rate of underreported concussions in Division II athletics; and the rate of underreported concussions between sports. These variables were measured based on specific items from the survey questionnaire (Miyashita, 2014).

Identifying Concussion Signs and Symptoms

The first research question examined whether the participating athletes could correctly identify the signs and symptoms of a concussion based on their current knowledge of the topic. When asked to identify the most common sign of a concussion, the majority of the athletes chose headache (56%), which is correct. The second most commonly reported symptom was dizziness (28%). Dizziness was followed by: loss of consciousness (7.2%), vomiting (2.4%), and sleepiness (.8%). Seven athletes (5.6%) chose not to answer this question. These results are illustrated in Figure 1.

At the end of the survey (Miyashita, 2014), athletes were asked to identify the signs and symptoms of a concussion, and were told to pick all answers that apply. As seen below in Table 5, all of the participating athletes (100%) correctly identified headache as a sign of a concussion. The majority of the athletes also correctly identified the following signs of a concussion: dizziness (97.6%), sensitivity to light and/or sounds (96%), vision issues (89.6%), loss of memory (86.4%), loss of consciousness (80.8%), and unequal pupils (59.2%). The majority of the participating athletes were also able to identify the incorrect answers. Of the participating athletes, (72%) said no to increased thirst, (67.2%) said no to chills, and (61.6%) said no to sensitivity to touch.

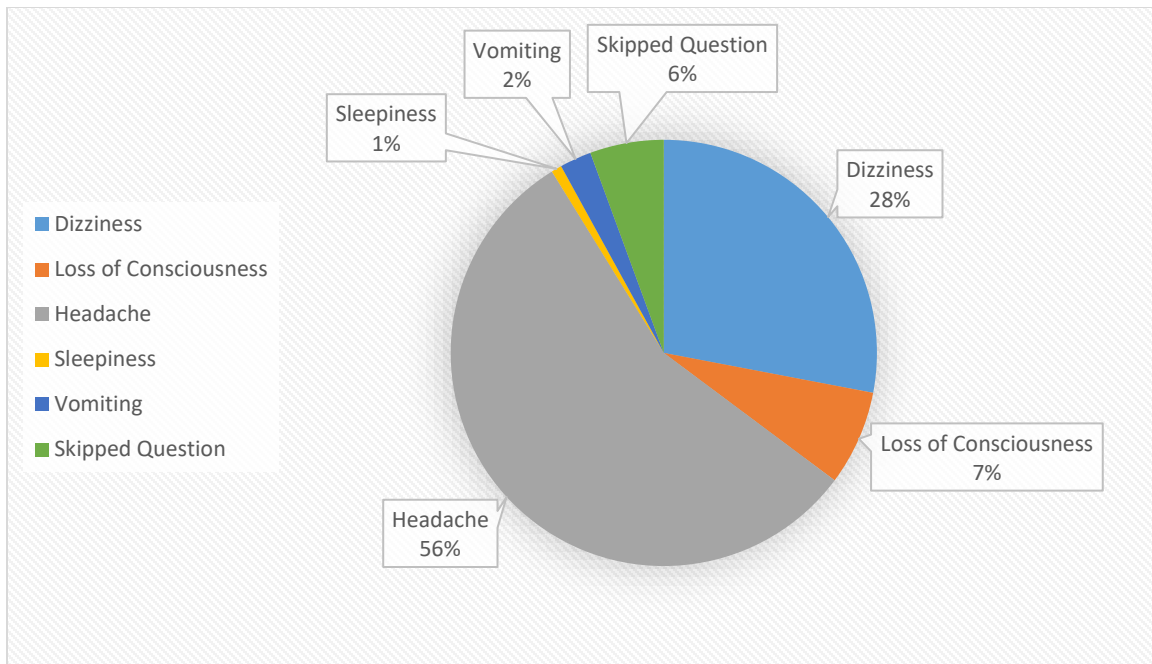


Figure 1. Identifying most common sign of concussion.

These results indicate that the Division II athletes surveyed have a good understanding of the signs/symptoms of a concussion. The participating athletes had trouble identifying pain under both eyes as an incorrect sign of a concussion, with (52%) saying yes, and (48%) saying no. Having pain under both eyes is not a recognized sign/symptom of a concussion though an athlete could experience pain under both eyes depending on the mechanism of injury.

Out of all eleven items for concussion knowledge, seven of them were correct. It was found that 63 athletes (50.4%) correctly identified all of the signs and symptoms of a concussion. Of the participating athletes, 32 (51.6%) football athletes correctly identified all of the signs and symptoms, as well as 6 (50%) basketball athletes, 11 (55%) soccer athletes, 5 (38.4%) volleyball athletes, and 9 (50%) dual sport athletes. It was found that 95 (76%) of the participating athletes were able to correctly identify at least 80% of the signs and symptoms of a concussion.

Table 5

Knowledge of Concussion Signs/Symptoms

		Frequency	Percentage
Dizziness*	Yes	122	97.6
	No	3	2.4
Headache*	Yes	125	100
	No	0	-
Vision Issues*	Yes	112	89.6
	No	13	10.4
Sensitivity to Light and/or Sounds*	Yes	120	96.0
	No	5	4.0
Unequal Pupils*	Yes	74	59.2
	No	51	40.8
Loss of Consciousness*	Yes	101	80.8
	No	24	19.2
Chills	Yes	41	32.8
	No	84	67.2
Increased Thirst	Yes	35	28.0
	No	90	72.0
Loss of Memory*	Yes	108	86.4
	No	17	13.6
Pain under both eyes	Yes	65	52.0
	No	60	48.0
Sensitivity to Touch	Yes	48	38.4
	No	77	61.6

*Note** The mean differences were significant at the 0.05 level

*Note** A star (*) after the Sign/Symptom indicates a correct sign or symptom of concussion

Factors Influencing Concussion Reporting Tendencies

The second research question of this study looked specifically at the different factors that could affect an athlete's decision to report their suspected concussion. When asked which factors would influence their decision to report their suspected concussion, 60% of the athletes said they would consider the intensity of their current symptoms.

As illustrated below in Figure 2, 41.6% of the participating athletes said they would consider the number of the current symptoms as an influencing factor when deciding when to report their suspected concussion. The majority of the athletes who participated (70.4%) said they would not consider the number of previous concussions that they have sustained. These results indicate that athletes might not understand the long-term effects of sustaining multiple concussions.

A few of the options for this item dealt with the athlete not wanting to disappoint their coaches, teammates, or parents, by reporting their suspected concussion. As illustrated below in Figure 2, the majority of the athletes would not consider disappointing their parents (72.8%) or coaches (52%) an influencing factor for reporting or not. The majority of the athletes would consider disappointing their teammates (54.4%) an influencing factor to report or hide their concussion.

Most athletes said they would also consider losing a starting position (52.8%), and sitting out of practices/games (57.6%) influencing factors when deciding whether or not to report their suspected concussion. The views of the fans were not considered an influencing factor with 95.2% of the athletes saying they would not consider what the fans think when it comes to reporting concussions. Two of the athletes chose "other", with one of them saying they would

consider “scholarships” an influencing factor and another athlete did not specify their reason for choosing other. These results are displayed below in Figure 2.

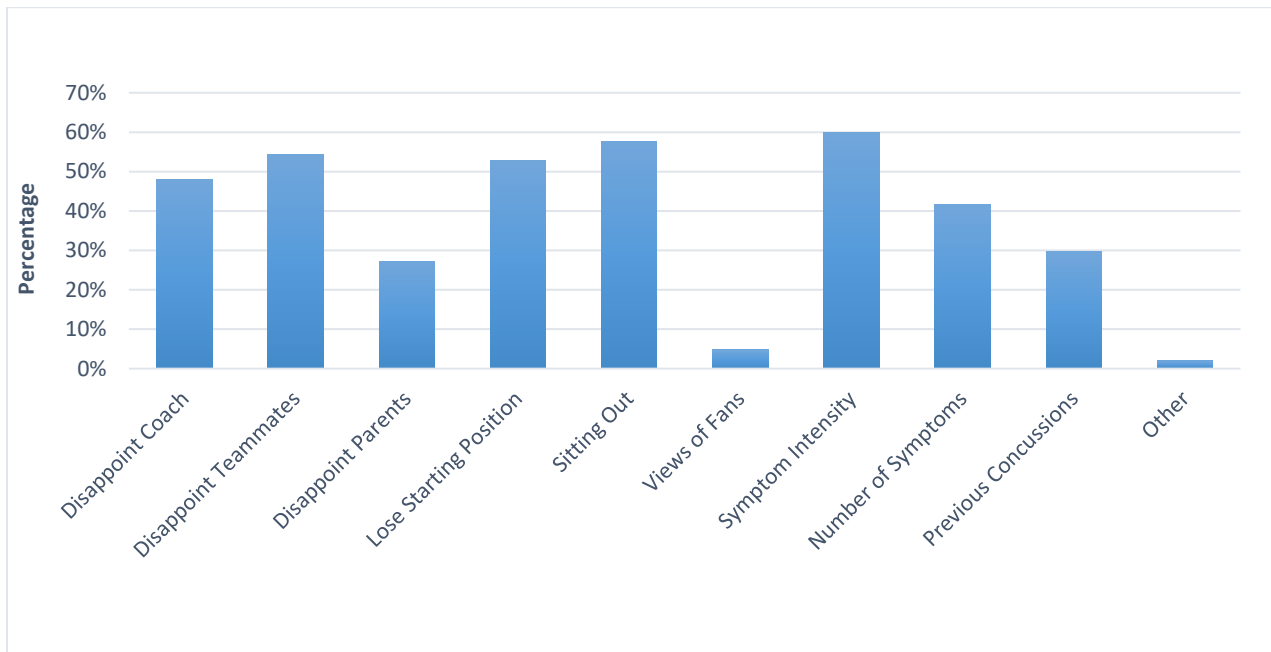


Figure 2. Factors influencing concussion reporting tendencies.

Rate of Underreported Concussions

The third research question of this study examined how often Division II athletes were reporting their suspected concussion. The most surprising result was how many of the football athletes did not report their suspected concussions (23%), which was the highest when compared to the other sports. Between all sports, a total of 20 athletes said they did not report their suspected concussion(s) at all. A total of 40 athletes said they did report their suspected concussion(s) specifically to a parent, coach, athletic trainer. Of the participating athletes, 51 of them had never sustained a concussion, and 14 athletes said they reported some of their suspected concussion(s), but not all of them. These results, illustrated below in Table 6, show that the underreporting of concussions is prevalent in the participants of this study.

Table 6

Concussion Reporting Tendencies by Sport

Sport	Concussions Reported			
	No	Yes	Some but not others	Never had a concussion
Basketball (n=12)	1 (8%)	4 (33%)	0	7 (59%)
Soccer (n=20)	1 (5%)	11 (55%)	4 (20%)	4 (20%)
Volleyball (n=13)	3 (23%)	3 (23%)	1 (8%)	6 (46%)
Football (n=62)	14 (23%)	21 (34%)	9 (14%)	18 (29%)
Dual Sport (n=18)	1 (6%)	1 (6%)	0	16 (88%)

Another item on the survey (Miyashita, 2014) specifically asked the athletes why they chose not to report their suspected concussion(s). Of the participating athletes, 58.4% reported all of their suspected concussions, or have never sustained a concussion. The number one reason for underreporting suspected concussions was the athletes “did not feel it was serious enough” (16%). The next most selected reasons were that they (1) did not want to miss playing time (9.6%), and (2) thought they could “tough” it out (3.2%). Of the participating athletes, 10 of them chose “other”, with 2 of them not specifying why they chose this option. Five of the athletes who chose “other”, had picked multiple answers. One athlete who chose “other” stated that they did not report their suspected concussion(s) because “you can only have so many in the NCAA before you cannot participate anymore”. Another athlete who chose “other” stated they “did not report the concussion but was asked questions and was fine”. A third athlete who chose “other” said they did not report their suspected concussion(s) because “I was 14 and had no idea that I could have had a concussion, even though I lost consciousness for a moment”. One of the

participating athletes chose not to answer this question. These results are illustrated below in Table 7. Together, Tables 6 and 7 show that the underreporting of concussions is prevalent in participants, and the athletes have multiple reasons for choosing not to report their suspected concussion(s). Concussions are considered unreported if an athlete feels that they have a suspected concussion, and they do not notify anyone about their condition.

Table 7

Reasons for Not Reporting Suspected Concussions

	Frequency	Percentage
Reported all concussions/never had a concussion	73	58.4
Did not feel it was serious enough	20	16.0
Did not want to miss playing time	12	9.6
I thought I could tough it out	4	3.2
Other	10	8.0

Underreported Concussions by Gender

My third hypothesis stated that female student-athletes would have a higher rate of reporting suspected concussion symptoms than male student-athletes. The data proved my hypothesis right, with the female athletes reporting more suspected concussions than the male athletes. Out of the participating athletes, 31.5% of the male athletes reported their suspected concussions, and 32.6% of the female athletes reported their suspected concussions. There were 16 (21.9%) male athletes who did not report their suspected concussions, with 9 (12.3%) males reporting some concussions, but not all of them. There were 4 (7.6%) female athletes who did not report their suspected concussions, with 5 (9.6%) females reporting some concussions, but not all of them. There were 25 (34.2%) male athletes who had never sustained concussions, and

26 (50%) female athletes who had never sustained a concussion. These results are illustrated below in Table 8.

Table 8

Concussions Reported by Gender

Concussions Reported	Gender		
	Male	Female	Total
No	16 (21.9%)	4 (7.6%)	20 (16%)
Yes	23 (31.5%)	17 (32.6%)	40 (32%)
Some but not all	9 (12.3%)	5 (9.6%)	14 (11.2%)
Never had a concussion	25 (34.2%)	26 (50%)	51 (40.8%)
Total	73	52	125

High-Risk Sports vs. Low-Risk Sports

My fifth hypothesis stated that the athletes involved in high-risk sports will report their suspected concussion symptoms less often than the athletes in low-risk sports. According to the NCAA, the high-risk sports are football, soccer, and basketball and the sports that are considered low-risk are volleyball and the dual sports, which were cross country and track. The data proved my hypothesis wrong, with the high-risk athletes reporting more suspected concussions (38.2%), than the low-risk athletes (13%). These results show that although some sports are considered low-risk, the participating athletes can still sustain concussions. These results are illustrated below in Table 9.

Table 9

High-Risk vs. Low-Risk Sports

Concussions Reported	High-Risk Sports				Low-Risk Sports		
	Football	Soccer	Basketball	Total	Volleyball	Dual Sports	Total
No	14 (23%)	1 (5%)	1 (8%)	16 (17%)	3 (23%)	1 (6%)	4 (13%)
Yes	21 (34%)	11 (55%)	4 (33%)	36 (38.2%)	3 (23%)	1 (6%)	4 (13%)
Some but not all	9 (14%)	4 (20%)	0	13 (13.8%)	1 (8%)	0	1 (3.2%)
Never had a concussion	18 (29%)	4 (20%)	7 (59%)	29 (30.8%)	6 (46%)	16 (88%)	22 (70.9%)
Total	62	20	12	94	13	18	31

Athletes Lying About Concussion Symptoms

The fourth research question of this study examined whether one sports team at Indiana University of Pennsylvania was reporting concussion more than others. Research question three showed that there were concussions that went unreported in Division II athletics at Indiana University of Pennsylvania. In order to determine if there was a significant correlation between sports in the occurrence of lying about concussion symptoms to return to play faster, a One-way analysis of variance was computed. It was determined that a moderately significant correlation was found between sports, and a Post-Hoc (Tukey HSD) test was computed to determine where that significance existed. The results of the Post-Hoc Tukey HSD can be found below in Table 10. It was found that the soccer athletes lied about their concussion severity to return to play faster significantly more than the dual sport athletes did. There was a significantly moderate correlation between soccer and dual sport athletes with $r=.50$, $p=.003$. This is significant because

50% of the soccer team stated that they have lied about the severity of their concussion symptoms to return to play faster. This is concerning because in Table 6, only one soccer athlete stated that they did not report their suspected concussion(s). There were no significant correlations between any of the other sports.

Table 10

Post Hoc Test Showing Lies About Concussions Between Sports

Sport		Correlation (p)
Basketball	Soccer	-.333 (.200)
	Volleyball	-.141 (.919)
	Football	-.091 (.959)
	Dual Sport	.167 (.826)
Soccer	Basketball	.333 (.200)
	Volleyball	.192 (.703)
	Football	.242 (.175)
	Dual Sport	.500* (.003)
Volleyball	Basketball	.141 (.919)
	Soccer	-.192 (.703)
	Football	.050 (.995)
	Dual Sport	.308 (.269)
Football	Basketball	.091 (.959)
	Soccer	-.242 (.175)
	Volleyball	-.050 (.995)
	Dual Sport	.258 (.156)
Dual Sport	Basketball	-.167 (.826)
	Soccer	-.500* (.003)
	Volleyball	-.308 (.269)
	Football	-.258 (.156)

Concussions Reported by Each Sport

In order to determine if there was a significant difference in how often each sport reported their suspected concussion(s), a One-way ANOVA was computed. The results show that there was a significant difference between sports ($F=4.881$, $p=.001$) when determining how many concussions went unreported. The results of this test are shown below in Table 11.

Table 11

One-Way ANOVA: Reported Concussions

	Did you report your suspected concussion?		<i>F</i>	<i>Sig.</i>
	Sum of Squares	Mean Square		
Between Groups	22.987	5.747	4.881	.001
Within Groups	141.285	1.177	--	--
Total	164.272	--	--	--

The results indicate that there is a significant difference between the sports and how many athletes reported their suspected concussion(s) to a coach, athletic trainer, parent, etc. In order to determine where the significance between the sports existed, A Post Hoc (Tukey HSD) test was computed. The results of the Post-Hoc Tukey HSD can be found below in Table 12. It was found that the soccer athletes reported their suspected concussion(s) significantly less than the dual sport athletes, with a mean difference of -1.172 ($p=.010$). The football athletes also reported their suspected concussion(s) significantly less than the dual sport athletes with a mean difference of -1.222 ($p=.000$). This is not surprising since Table 6 shows that 14 football athletes did not report their suspected concussion(s), while 9 football athletes reported some concussions, but not others. There were no significant differences between football and soccer athletes, or any of the other sports.

Table 12

Post Hoc Test Showing Reporting Tendencies Between Sports

		Mean Difference (p)
Basketball	Soccer	.533 (.663)
	Volleyball	.314 (.951)
	Football	.583 (.435)
	Dual Sport	-.639 (.513)
Soccer	Basketball	-.533 (.663)
	Volleyball	-.219 (.980)
	Football	.050 (1.000)
	Dual Sport	-1.172* (.010)
Volleyball	Basketball	-.314 (.951)
	Soccer	.219 (.980)
	Football	.269 (.926)
	Dual Sport	-.953 (.119)
Football	Basketball	-.583 (.435)
	Soccer	-.050 (1.000)
	Volleyball	-.269 (.926)
	Dual Sport	-1.222* (.000)
Dual Sport	Basketball	.639 (.513)
	Soccer	1.172* (.010)
	Volleyball	.953 (.119)
	Football	1.222* (.000)

Note The mean difference is significant at the 0.05 level*

Summary

This chapter presented an analysis of the data gathered from the survey questionnaire. The results were used to answer the research questions that guided this study. The four research questions were answered with the following results; 1) 100% of the athletes correctly identified headache as a sign of a concussion; 50.4% of the athletes correctly identified all of the correct signs/symptoms; and 76% of the athletes identified at least 80% of the correct signs/symptoms; 2) the most common reason athletes chose not to report their suspected concussion was because they did not feel it was serious enough (16%), although other factors were considered as well; 3) athletes are reporting concussions more often than not, with a total of 40 athletes reporting, 20 not reporting, and 14 reporting some concussions, but not all; and 4) both the soccer ($p=.010$) and football ($p=.000$) athletes reported their suspected concussion(s) significantly less than dual sport athletes, with no other significant differences between the other sports.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study examined student athletes' concussion reporting tendencies, as well as their knowledge of concussions. Out of approximately 350 athletes at Indiana University of Pennsylvania, 125 completed the survey (35.7%). Analysis were conducted to determine what factors impacted concussion reporting tendencies, how often athletes were reporting their suspected concussions, and which sports team was reporting their suspected concussions the most and least. Demographic variables (i.e. gender, year in college, age, and sport) were also collected and analyzed.

Chapter 1 outlined the purpose of this study including the dangers of concussions and the importance of reporting them. Chapter 2 reviewed the prevalence of concussions, the common signs/symptoms of concussion, and the occurrence and dangers of underreporting suspected concussions in athletics. Chapter 3 outlined the study's procedures including participant selection, and how the data were collected. Chapter 4 presented the results of the study by answering the four research questions presented in Chapter 1, and providing tables with statistics. Chapter 5 summarizes the study results presented in Chapter 4, provides suggestions for athletic departments, coaches, and athletes, and makes recommendations for further research studies.

Conclusion/Discussion

This research study focuses on four research questions that relate to Division II collegiate athletes' perceptions of concussions, as well as their reporting tendencies and the factors that could influence them. In completing this survey, student athletes reported their demographics,

previous concussion history, and their tendencies to report suspected concussions. The survey also had the athletes identify common signs and symptoms of concussions. Each research question is outlined below, with the focus of significant findings related to each question.

Research Question One

The first research question of this study examined whether the participating athletes could correctly identify the signs and symptoms of a concussion, based on their current knowledge of concussions. When asked to identify the signs/symptoms of a concussion, all of the participating athletes chose headache (100%), which is correct. Of the participating athletes, 50.4% were also able to identify dizziness, loss of consciousness, loss of memory, sensitivity to light and/or sounds, vision issues, and unequal pupils as common signs of a concussion. All of these signs/symptoms are listed in the study conducted by Nelson, Janeck & McCrea, (2013). This shows that the participating athletes have a good understanding of concussions signs/symptoms. It is important for athletes to understand that although some athletes can lose consciousness immediately after sustaining a hit to the head, a loss of consciousness alone is not considered a defining characteristic of a concussion (Nelson, Janecek, & McCrea, 2013). The symptoms that an athlete can experience after a concussion will depend on the resilience of the athlete, and the severity of the injury.

Some athletes had a hard time determining whether “pain under both eyes” was a sign of a possible concussion, with (52%) saying yes, and (48%) saying no. Having pain under both eyes is not a recognized sign/symptom of a concussion (Nelson, Janecek, & McCrea, 2013). An athlete could possibly experience pain under both eyes depending on the mechanism of injury, such as being hit in the face with a baseball or bat. When asked to identify the most common sign of a concussion, (2.4%) of the athletes said vomiting and (.8%) of the athletes said

sleepiness. Although these percentages are low, it shows that athletes could benefit from an informative session that discusses the signs/symptoms of concussions, the dangers of sustaining multiple concussions, and the importance of reporting suspected concussions immediately.

It is important that athletes know and understand the signs/symptoms of concussions because medical professionals rely heavily on athletes to self-report their symptoms in order to diagnose a concussion (McBride, 2012). It is important that athletes have the ability to identify and report their symptoms, because there are many dangers associated with leaving symptoms untreated and sustaining multiple concussions. In a previous study, some athletes chose to return to play while experiencing symptoms because they were unaware that the symptoms were associated with a concussion (Baugh et al., 2014). Previous research shows that when an athlete sustains multiple concussions, they are at a higher risk of developing more serious post-concussion problems, including Second Impact Syndrome (SIS) and Chronic Traumatic Encephalopathy (CTE) (Edwards & Bodle, 2014).

Research Question Two

The second research question of this study looked specifically at the different factors that could affect an athlete's decision to report their suspected concussion. Of the participating athletes, 70.4% of them reported that they would not consider the number of previous concussions that they have sustained when deciding if they were going to report their suspected concussion. These results indicate that Division II athletes at Indiana University of Pennsylvania might not understand the dangers of sustaining multiple concussions. Previous research shows that sustaining multiple concussions, and/or leaving concussions untreated, can lead to more serious problems such as CTE and SIS (Edwards & Bodle, 2014). Although the majority of the participating athletes would not consider their concussion history in their decision to report,

41.6% of the athletes said they would consider the number of their current symptoms, and 60% said they would consider the intensity of their current symptoms. These results lead to the assumption that the athletes will try to “tough it out” if their symptoms are not severe.

Other items of this question asked the athlete if disappointing their coaches, teammates, or parents, would influence their decision to report their suspected concussion. The results were interesting because the majority of the athletes would not consider disappointing their parents (72.8%) or coaches (52%) an influencing factor. This is supported by previous research, where freshman football players agreed that their coach supported the reporting of suspected concussion symptoms (Baugh et al., 2014). The majority of the athletes would consider disappointing their teammates (54.4%) an influencing factor to report or hide their concussion. If coaches and teammates create an environment that supports the reporting of concussion signs and symptoms, it is possible that more athletes will report their suspected concussions.

Research Question Three

The third research question of this study examined how often Division II athletes were reporting their suspected concussion. Previous research shows that between 30% and 50% of suspected concussions go unreported by athletes (Asken et al., 2016). Of the participating athletes, 51 either 1) reported all of their concussions, or 2) had never sustained a concussion. The majority of the athletes in this study (n = 40) did report their suspected concussion to their coach, athletic trainer, parent, etc. The results indicate that the Division II athletes at Indiana University of Pennsylvania appear to be reporting their suspected concussions more often than not. A total of 20 athletes said they did not report their suspected concussion(s), with 14 athletes saying they reported some concussions, but not all. 14 out of the 20 athletes who did not report suspected concussions were on the football team. These results indicate that the football team

could use more information about the importance of immediately reporting suspected concussions. Previous research shows athletes who immediately reported their concussion symptoms and were immediately removed from activity had a shorter recovery time than the athletes who delayed the reporting of concussion symptoms and were not immediately removed from activity (Asken, et al., 2016). The participating athletes might not understand the dangers of continuing to play while experiencing concussion symptoms. Previous research shows that continuing to participate in activity after sustaining a concussion can lead to further neurological damage to the already injured brain (Asken, et al., 2016).

This research question also examined the different reasons why the participating athletes chose not to report their suspected concussion(s). The top three reasons for underreporting suspected concussions in this study were that the athletes 1) did not feel it was serious enough (16%); 2) did not want to miss playing time (9.6%); and 3) thought they could tough it out (3.2%). A similar study (Davies & Bird, 2015) had very similar results, including (1) they did not think the concussion was a serious enough injury, (2) they did not want to be pulled out of the practice or game, and (3) they did not know that they had sustained a concussion. These results indicate that the athletes might need more information about the signs/symptoms of a concussion.

One athlete who chose “other” stated that they did not report their suspected concussion(s) because “you can only have so many in the NCAA before you cannot participate anymore”. This indicates that some athletes could be more concerned about their playing time than their health, which also indicates that they might not understand the severity of concussions. Another athlete who chose “other” stated he/she “did not report the concussion but was asked questions and was fine”. Therefore, it is important to have coaches, teammates, and athletic

trainers who understand the signs/symptoms of concussions, because they can intervene if they notice something and make sure the player is alright. A third athlete who chose “other” said they did not report their suspected concussion(s) because “I was 14 and had no idea that I could have had a concussion, even though I lost consciousness for a moment”. Again, this answer relates to the athletes not understanding the signs/symptoms of concussions.

Research Question Four

The fourth research question of this study examined whether one sports team at Indiana University of Pennsylvania was reporting concussion more frequently. This relates to research question three, which showed that there are concussions that go unreported in Division II athletics at Indiana University of Pennsylvania. One of the items on the survey (Miyashita, 2014), asked the athletes if they had ever lied about the severity of a concussion to return to play faster. It was found that the soccer athletes lied about their concussion severity to return to play significantly ($r = .500$, $p = .003$) more than the dual sport athletes did. This is significant because 50% of the soccer team lied about the severity of their concussion symptoms to return to play faster. Only one soccer athlete stated that they did not report their suspected concussion(s), meaning that overall, the soccer athletes are reporting their concussions but generally lie about their symptoms to get back to play faster. There were no significant differences between any of the other sports. Previous research shows that football accounts for about 50% of all concussions, with Women’s soccer typically having the second highest rate of concussions (Miyashita, et al., 2014). The results indicate that the soccer team could benefit from more information about the dangers of playing while experiencing concussion symptoms. Previous research shows that once an athlete sustains a concussion, they are up to four times as likely to sustain a second concussion (McBride, 2012). When an athlete sustains a concussion and then lies about their

symptoms to return to play faster, they are putting their health at a serious risk. Research shows that Second Impact Syndrome occurs when an athlete suffers multiple concussions while the brain is in a vulnerable state of healing, and it can be fatal (Edwards & Bodle, 2014).

This question also examined the reporting tendencies of each sports team at Indiana University of Pennsylvania. It was found that the soccer athletes and the football athletes reported their suspected concussion(s) significantly less than the dual sport athletes did. There were no significant differences between football and soccer, or any of the other sports. These results are not surprising since Table 8 shows that 14 football athletes did not report their suspected concussion(s), and 9 football athletes reported some concussions, but not others. It was not surprising that soccer reports their suspected concussions significantly less than the dual sport athletes, because they were the only team that significantly lied about the severity of their concussion symptoms to return to play faster. Again, the results indicate that these athletes need more information about the signs/symptoms of concussions, the dangers of sustaining multiple concussions (especially while still healing), and the importance of immediately reporting their suspected concussions. Previous research shows that increased knowledge of concussions in athletes was associated with an increase in reporting suspected concussion symptoms and the occurrence of “bell-ringer” events in practices, as well as in general (Register-Mihalik, et al., 2013).

Recommendations

Recommendations for Athletic Departments

Student athletes were given several opportunities to expand on their concussion reporting tendencies and the factors that may affect their decision to report a suspected concussion. Athletes reported several issues that could influence their decision to report a suspected

concussion, with the most reported answer being the intensity of their current symptoms, which is an unchangeable factor. Over 50% of the athletes reported that losing a starting position would affect their decision to report a suspected concussion. One participant chose “other” and stated that they would consider their scholarship status when deciding to report a suspected concussion.

When the athletes were asked why they chose not to report a suspected concussion, the number one reason for underreporting suspected concussions was the athletes “did not feel it was serious enough” (16%). The next most popular answers were they (1) did not want to miss playing time (9.6%), and (2) thought they could “tough” it out (3.2%). One participant who chose “other”, stated that they did not report their suspected concussion because “you can only have so many in the NCAA before you cannot participate anymore”. This shows that athletes need more information about the signs and symptoms of concussions, the dangers of sustaining multiple concussions, and the dangers of letting suspected concussions go untreated.

The overall response was that most athletes are reporting their suspected concussions (58.4%) to an athletic trainer, coach, parent, or other trusted individual. Some athletes are still underreporting suspected concussions for multiple different reasons with the most common reasons being: lack of knowledge of signs and symptoms, being worried about losing a starting position, and sitting out of practices and/or games.

Personal recommendations for athletic departments working with student athletes would include informative sessions about concussion awareness for all athletic trainers, coaches, and student athletes. These sessions should be held once a year so that new athletes are included, and the older athletes can go over the information again, just in case they forgot anything. Although these individuals may have had similar reasons for hiding suspected concussions, each athlete will respond in their own way depending on different personal situations. Universities should

also provide a concussion resource center (typically the athletic training room) where athletes can go to get more information about concussions, and talk to a medical professional to address any additional questions or concerns that they may have. Coaches and teammates should work together to create a positive athletic environment that supports the reporting of all injuries. The sooner an athlete reports any injury, especially concussions, the sooner they will be able to return to their sport.

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Appendix A

Student Athletes' Perceptions of Concussion Survey

Demographic Questions

1. What is your age?
 - a. 18
 - b. 19
 - c. 20
 - d. 21
 - e. Over 21
2. What is your gender?
 - a. Male
 - b. Female
3. Year in college
 - a. Freshman
 - b. Sophomore
 - c. Junior
 - d. Senior
 - e. 5th Year Student
4. What NCAA sport(s) do you participate in at IUP?

<input type="checkbox"/> Basketball	<input type="checkbox"/> Softball
<input type="checkbox"/> Soccer	<input type="checkbox"/> Lacrosse
<input type="checkbox"/> Field Hockey	<input type="checkbox"/> Cross Country
<input type="checkbox"/> Volleyball	<input type="checkbox"/> Football
<input type="checkbox"/> Tennis	<input type="checkbox"/> Baseball
<input type="checkbox"/> Swimming	<input type="checkbox"/> Golf
<input type="checkbox"/> Track & Field	

Student Athletes' Perceptions of Concussion Survey

5. Do you know who your athletic trainer is?
 - a. Yes
 - b. No
6. Have you ever had your "bell rung"?
 - a. Yes
 - b. No

7. How many suspected concussions have you sustained in your entire life?
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. More than 3
8. Did you report your suspected concussion to your coach, athletic trainer, parent, etc?
 - a. Yes
 - b. No
 - c. I have reported some concussions, but not others
 - d. I have never had a concussion
9. If you **did not** report your suspected concussion(s), how many did you not report?
 - a. 3 or more
 - b. 2
 - c. 1
 - d. I have never had a concussion
10. If you did not report your suspected concussion, why did you choose not to report?
 - a. Did not feel it was serious enough
 - b. Did not want to miss playing time
 - c. I thought I could tough it out
 - d. I did not want coach to get mad at me
 - e. I reported all concussions/have never sustained a concussion
 - f. Other: _____
11. Do you believe that you are immune to the long-term effects of concussions?
 - a. Yes
 - b. No
12. Have you ever lied about the severity of a concussion to return-to-play faster?
 - a. Yes
 - b. No
13. Do you believe the importance of game/event should impact when you return to play following a concussion?
 - a. Yes
 - b. No
14. Do you believe baseline testing (testing you do before the season) is an important part of managing a concussion?
 - a. Yes
 - b. No

15. What do you believe is the most common concussion symptom?
- Dizziness
 - Loss of consciousness
 - Headache
 - Sleepiness
 - Vomiting
16. What do you believe is the best treatment after having a concussion?
- Advil
 - Aleve
 - Tylenol
 - No medication, just rest
17. Do you think there are long-term side effects to sustaining multiple concussions?
- Yes
 - No
18. Could a concussion have an impact on your education/schooling?
- Yes
 - No
19. Do you know your schools' return-to-play protocol following a concussion?
- Yes
 - No

Knowledge of Concussions

1. Which of the following symptoms indicate a concussion? (pick all that apply)
- | | |
|---|--|
| <input type="checkbox"/> Dizziness | <input type="checkbox"/> Pain under both eyes |
| <input type="checkbox"/> Headache | <input type="checkbox"/> Sensitivity to touch |
| <input type="checkbox"/> Vision issues (blurry vision, double vision, etc.) | <input type="checkbox"/> Unequal pupils |
| <input type="checkbox"/> Sensitivity to light and/or sounds | <input type="checkbox"/> Loss of consciousness |
| <input type="checkbox"/> Loss of memory | <input type="checkbox"/> Chills |
| | <input type="checkbox"/> Increased thirst |
2. Which of the following factors would influence your decision to report a suspected concussion? (pick all that apply)
- | | |
|---|--|
| <input type="checkbox"/> Don't want to disappoint coaches | <input type="checkbox"/> How the fans will view me |
| <input type="checkbox"/> Don't want to disappoint teammates | <input type="checkbox"/> The intensity of my current symptoms |
| <input type="checkbox"/> Don't want to disappoint parents | <input type="checkbox"/> The number of my current symptoms |
| <input type="checkbox"/> Losing a starting position | <input type="checkbox"/> How many concussions I've had in the past |
| <input type="checkbox"/> Sitting out of practices/games | <input type="checkbox"/> Other: _____ |

Appendix B
Site Approval Letter

Indiana University of Pennsylvania

Kinesiology, Health, and Sport Science Department Phone: 724-357-2771
Zink Hall, Room 225 Fax: 724-357-3777
1190 Maple Street Internet: <http://www.iup.edu/kines/>
Indiana, PA 15705

November 29th, 2016

Dear Mr. Roach:

I am writing this letter to introduce you to a study that I will be conducting with division II collegiate athletes at IUP that will evaluate their perceptions of concussions. The purpose of this project is to provide an insight into athletes' perceptions of concussion symptoms and the factors that influence an athlete's tendency to report concussion symptoms. Results of this study will be presented and published.

As the Director of Athletics at IUP, we are writing you to specifically request site approval to conduct our study. We are interested in working with your office to help recruit current IUP athletes to complete a brief survey questionnaire. The survey will take the students around 10 minutes to complete, and the results will help IUP's athletic department determine which sports teams might need more information about concussions and which sports teams are more likely to report their symptoms. This will create a safer athletic environment for current and future IUP athletes.

By signing, you are simply granting us permission to work with coaches to attend scheduled team meetings in the spring 2017. With your permission, I will work with each coach to find an appropriate time to attend these team meetings and distribute the survey to athletes who are willing to participate in the study. All information that we receive will be maintained in accordance with federal regulations. By agreeing to this role as part of our study, you will have access to all of the finished data results for use in your office. If this is acceptable, please sign and date below.

This project will be approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730) prior to starting this study.

Thank you very much for your time and consideration.

Brittany L. Billand, B.S, LAT, ATC
Graduate Student
Department of Kinesiology, Health, and Sport Science
Phone: (717)-688-8198
E-Mail: b.l.billand@iup.edu

David A. Wachob, D.Ed, CAPE, CHES
Faculty Sponsor
Department of Kinesiology, Health, and Sport Science
Phone: (724) 357-3194
Fax: (724) 357-3777
E-Mail: d.wachob@iup.edu

SITE APPROVAL STATEMENT:

Yes, I give permission for you to use Memorial Field House as a study site for this research project continent upon receiving approval by the Indiana University of Pennsylvania Institutional Review Board for the protection of human subjects.

Signature:  _____

Date: 12/13/16 _____

Print name: Steve Roach _____

Title: Athletic Director _____

Appendix C

Informed Consent Form

Indiana University of Pennsylvania

Department of Kinesiology, Health, & Sport Science
Zink Hall, Room 225
1190 Maple Street
Indiana, Pennsylvania 15705-1087

Phone: 724-357-3194
Internet: <http://www.iup.edu/kines>

My name is Brittany Billand and I am a Graduate student in the Kinesiology, Health, and Sport Science department at Indiana University of Pennsylvania. I am working on a Master of Education Degree in Athletic Coaching Education. I am requesting your assistance with my research study. Outlined in this consent form is information about my research so that you can decide if you want to participate in this study. It is OK for you to ask me questions about the study. My telephone number and e-mail address are listed at the bottom of this form. I would like you to help me because you are a student athlete here at IUP.

What is the goal of this study?

I am conducting this study so I can learn more about college student athletes' perceptions of concussion and their tendencies to report suspected symptoms.

How many people will take part in the study?

About 350 IUP student-athletes will be asked to participate in the study. I hope you will consider participating in this study because I value your input.

If you agree to take part in the study, what would you need to do?

You will be asked to complete the Student Athletes' Perceptions of Concussion survey. This survey will consist of twenty-one multiple choice questions. Student-athletes will be asked about their age, gender, academic year in school, and sport(s) played at IUP. The survey will take around 10 minutes to complete. Completion of the survey will serve as your informed consent to participate in the study.

Can being in the study hurt you?

There are no risks associated with participating in this research study. Participation in this study is completely voluntary and anonymous. You can choose not to take the survey, skip questions that you don't want to answer, or stop responding to the survey at any point in time. Refusal to participate in the study will cause no penalties to the student athlete. Once a student-athlete turns in their completed survey, they cannot withdraw their answers because I will have no way of identifying their responses.

What are the potential benefits if you join this study?

Participating in this study will help IUP's athletic department determine which sports teams might need more information about concussions and which sports teams are more likely to report their symptoms. This will create a safer athletic environment for current and future IUP athletes.

What other options do you have?

Participation in this study is voluntary. Athletes who do not want to complete the survey will not be penalized in any way. This study will be conducted at the end of a scheduled team meeting time, so athletes who do not want to participate simply leave the room since the meeting is over and the coaches have dismissed the athletes.

How would I keep your information confidential?

All completed surveys are anonymous, meaning I will not have any identifiable information about you. At the end of the study, I will store all research records in a locked cabinet in an office in Zink Hall and secure password protected computer files for three years. I will not put names on any research data. When I finish my research study, I will present my findings with other educators or researchers or publish the research, but I will always talk about groups of students or results, never about you personally. I will never share identifying information with anyone.

Project Director

Brittany L. Billand, B.S., LAT, ATC
Graduate Student
Email: mvms@iup.edu
Department of Kinesiology, Health, & Sport Science

Faculty Sponsor

David A. Wachob, D.Ed, CAPE, CHES
Department of Kinesiology, Health, and Sport Science
Phone: (724) 357-3194
E-Mail: d.wachob@iup.edu

This project was approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects (Phone: 724-357-7730).

Appendix D

Permission to Use Instrument

Subject: Re: Permission to use Study Instrument
From: Miyashita, Prof. Theresa L. <miyashitat@sacredheart.edu>
Date: 10/31/16 04:18 AM
To: d.wachob@iup.edu <d.wachob@iup.edu>
Cc: b.l.billand@iup.edu <b.l.billand@iup.edu>

This message has attached files. Show

HS Concussion Presentation_Miyashita.pptx (843 KB)

Attached Files

HS Concussion Presentation_Miyashita.pptx (843 KB)

Hello Dave,

Sorry for the delay! Just getting back to everything. I've attached the presentation I used to collect the data. We used iClickers, so there was not an opportunity for open-ended responses. Also, at this point in time, some info needs updating from when I used it. The info re: the RTP policy was the school district's policy at that point in time (nothing I made up/created).

If you have any questions/concerns, please let me know!

Theresa

Theresa Miyashita, Ph.D., ATC, PES, CES
Program Director
Athletic Training Education Program
Sacred Heart University
miyashitat@sacredheart.edu
o: (203) 365-4509

Appendix E

CITI Training

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2 COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Brittany Billand (ID: 5954664)
- **Institution Affiliation:** Indiana University of Pennsylvania (ID: 1711)
- **Institution Unit:** Kinesiology, Health, and Sport Science

- **Curriculum Group:** Human Subjects Research
- **Course Learner Group:** Social, Behavioral, Educational Researchers
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 21454955
- **Completion Date:** 19-Jan-2017
- **Expiration Date:** N/A
- **Minimum Passing:** 80
- **Reported Score:** 89

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
History and Ethical Principles - SBE (ID: 490)	19-Jan-2017	4/5 (80%)
Defining Research with Human Subjects - SBE (ID: 491)	19-Jan-2017	4/5 (80%)
The Federal Regulations - SBE (ID: 502)	19-Jan-2017	5/5 (100%)
Assessing Risk - SBE (ID: 503)	19-Jan-2017	5/5 (100%)
Informed Consent - SBE (ID: 504)	19-Jan-2017	4/5 (80%)
Privacy and Confidentiality - SBE (ID: 505)	19-Jan-2017	5/5 (100%)
Belmont Report and CITI Course Introduction (ID: 1127)	19-Jan-2017	3/3 (100%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	19-Jan-2017	5/5 (100%)
Students in Research (ID: 1321)	19-Jan-2017	5/5 (100%)
Research with Prisoners - SBE (ID: 506)	19-Jan-2017	5/5 (100%)
Research and HIPAA Privacy Protections (ID: 14)	19-Jan-2017	2/5 (40%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify/7kfd1a6ed3-8f81-4e50-9aae-1104b335e60c-21454955

CITI Program
Email: support@citiprogram.org
Phone: 833-529-5929
Web: <https://www.citiprogram.org>

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COMPLETION REPORT - PART 2 OF 2
COURSEWORK TRANSCRIPT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Brittany Billand (ID: 5964664)
- **Institution Affiliation:** Indiana University of Pennsylvania (ID: 1711)
- **Institution Unit:** Kinesiology, Health, and Sport Science

- **Curriculum Group:** Human Subjects Research
- **Course Learner Group:** Social, Behavioral, Educational Researchers
- **Stage:** Stage 1 - Basic Course

- **Report ID:** 21454955
- **Report Date:** 19-Jan-2017
- **Current Score**:** 89

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT	SCORE
Students in Research (ID: 1321)	19-Jan-2017	5/5 (100%)
History and Ethical Principles - SBE (ID: 490)	19-Jan-2017	4/5 (80%)
Defining Research with Human Subjects - SBE (ID: 491)	19-Jan-2017	4/5 (80%)
Belmont Report and CITI Course Introduction (ID: 1127)	19-Jan-2017	3/3 (100%)
The Federal Regulations - SBE (ID: 502)	19-Jan-2017	5/5 (100%)
Assessing Risk - SBE (ID: 503)	19-Jan-2017	5/5 (100%)
Informed Consent - SBE (ID: 504)	19-Jan-2017	4/5 (80%)
Privacy and Confidentiality - SBE (ID: 505)	19-Jan-2017	5/5 (100%)
Research with Prisoners - SBE (ID: 506)	19-Jan-2017	5/5 (100%)
Research and HIPAA Privacy Protections (ID: 14)	19-Jan-2017	2/5 (40%)
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	19-Jan-2017	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify?xf01a6ed3-8f81-4e50-9aae-1104b335e60c-21454955

Collaborative Institutional Training Initiative (CITI Program)
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 Web: <https://www.citiprogram.org>