

[Barry University](#)
[Institutional Repository](#)

[Theses and Dissertations](#)

2013

**Concussion Safety Knowledge and Awareness Among Coaches,
Athletic Trainers, and Athletic Directors Regarding High School
Football**

Vanessa Gonzalez

BARRY UNIVERSITY
SCHOOL OF HUMAN PERFORMANCE AND LEISURE SCIENCES

CONCUSSION SAFETY KNOWLEDGE AND AWARENESS AMONG COACHES,
ATHLETIC TRAINERS, AND ATHLETIC DIRECTORS REGARDING HIGH SCHOOL
FOOTBALL

BY

Vanessa Gonzalez

A Thesis submitted to the
Department of Sport and Exercise Sciences
in partial fulfillment of the
requirements for The Degree of
Master of Science in
MOVEMENT SCIENCE
With a specialization in
INJURY AND SPORT BIOMECHANICS

Miami Shores, Florida
2013

BARRY UNIVERSITY
MIAMI SHORES, FLORIDA

September 27, 2013

To the Dean of the School of Human Performance and Leisure Sciences:

I am submitting here with a thesis written by Vanessa Gonzalez entitled "Concussion Safety, Knowledge, and Awareness Among Coaches, Athletic Trainers, and Athletic Directors Regarding High School Football." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science with a major in Athletic Training.

Dr. Yi-Tzu Kuo, Thesis Committee Chair

We, members of the thesis committee,
have examined this thesis
and recommend its acceptance:

Accepted:

Chair, Department of Sport and Exercise Sciences

Accepted:

Dean, School of Human Performance and
Leisure Sciences

Barry University

ABSTRACT

Concussion Safety, Knowledge, and Awareness Among Coaches, Athletic Trainers, and Athletic

Directors Regarding High School Football

Vanessa Gonzalez

Thesis Committee Chair: Dr. Yi-Tzu Kuo

Degree of Master of Athletic Training with a specialization in Movement Science
Department of Sport and Exercise Sciences

Concussions have become part of the fine print in the imaginary contract an athlete signs when participating in a contact sport like football. A concussion is a traumatic brain injury that is characterized by immediate but transient post traumatic impairment of brain functions (Starky, Brown, & Ryan, 2010). In 2006 a middle school football player named Zachery Lystedt suffered a life changing concussion leaving him disabled for the rest of his life. Due to this incident, in 2009 the state of Washington passed a new law named after Zachery to protect youth football players from repeating the same fate. Florida soon followed by establishing a similar law on April 27, 2012. The law enacted stated that Florida High School Athletic Association (FHSAA) will adopt these new guidelines, and policies relating to the nature and risk of concussion and head injury in youth athletes. This will include requiring informed consent for participation in practice or competition; requiring removal from practice or competition under certain circumstances and written medical clearance to return; requiring the Florida High School Athletic Association to adopt bylaws for the establishment and duties of a sports medicine advisory committee; specifying membership; providing an effective date. (State of Florida, 2012).

The inclusion criteria for this study require participants to be high school football coaches, certified athletic trainers, and athletic directors. Any other administrator was excluded from participating in this survey. The survey was made available to high school football coaches, certified athletic trainers, and athletic directors via email. The purpose of this survey was to identify if coaches, athletic trainers and athletic directors have been compliant with the new concussion regulations as well as to identify if a sufficient job was done in enforcing these newly implemented regulations. The survey contained questions about the participant's administrative position, the number of concussions seen in the past year, referral to physicians, and return to play guidelines. Results were predicted to show a lack of concussion safety according to new regulations, although there was not a large number of participants some significance was found in lack of understanding and compliance with the new concussion regulation throughout all the participants.

Acknowledgments

This might be one of the hardest things that a person can endure between sleepless nights and stressful days that seemed never ending. But the process of writing a thesis has finally come to an end. I have to thank God for giving me the strength and will to keep going every day, even in those times were I just wanted to give up.

I would like to thank everyone who helped me through this process and was there for me during the times that I felt like giving up. I would like to thank the three wonderful women in my committee, Dr. Kuo, Dr. Tashman, and a very special thank you to Dr. Shapiro. As many have probably said to you before, you are an amazing woman both on and off the field, you care for all your students becoming a mom away from home. Thank you for everything you have given me in the last five years and I can only hope to follow in your footsteps.

To my wonderful family, thank you all for always being there and understanding. To my brother and sister-in-law thank you for always giving me words of encouragement and motivation. You both went through this process with me and knew when I needed to let out some stress and when I just needed to be left alone, I appreciate all the sacrifices you made to help me get my work done. To my biggest supporter and reinforcement, my mom. She always told me to be strong and never stop chasing my dreams, I never gave up so I can see her happy. Thank you for always praying for me and wiping my tears I love you more than words can even begin to describe!

I want to thank my friends for never leaving me after ditching them over and over again this past year. Alyson, you always had time to listen and bring a smile to my face I can't thank

you enough for being there for me! To the Fab-5, we are all going places guys! We have yet to begin our journey. To my behind the scenes supporter, thank you immensely for picking up my calls at work, and at 3 and 4 in the morning when I felt defeated. I have to admit this is as much yours as it is mine, you were an incredible motivation and never hesitated to be there exactly when I needed you.

Thank you all, I will forever be grateful of everything you did for me!

Table of Contents

Signature Page.....ii
Abstract.....iii
Acknowledgments.....v
Table of Contents.....vii

Chapter1

Introduction.....1
 Statement of the Problem.....7
 Significance of the Study.....7
 Research Hypothesis.....8
 Null Hypothesis.....8
 Limitations.....8
 Delimitations.....9
 Assumptions.....9
 Operational Definitions.....9

Chapter 2

Literature Review.....12
 Concussion Testing.....12
 Causes of a Concussion.....17
 Concussion Awareness.....19

Chapter 3

Methods.....22

Participants.....	22
Instrumentation.....	23
Procedures.....	23
Statistical Analysis.....	24
Chapter 4	
Results.....	25
Concussion Regulation Awareness.....	25
Concussion Education.....	26
Availability of Physician.....	27
Chapter 5	
Discussion.....	25
Consensus/Demographics.....	29
Concussion Regulation Awareness.....	30
Concussion Education.....	31
Availability of Physician.....	34
Conclusion.....	35
References.....	38
Appendices.....	42
Appendix A: Figures and Tables.....	42
Appendix B: Questionnaire.....	49
Appendix C: Informed Consent Form.....	52

Chapter 1

Introduction

Concussions have become part of the fine print in the imaginary contract an athlete signs when participating in a contact sport like football. The problem with the above statement is that a concussion can be life changing for an athlete; can the love for the sport or the hunger for the fame be worth a traumatic life changing injury? Traumatic injuries that happen at the professional level receive all the attention of the media, but what about these injuries that occur to athletes in high school or even worse, to children in middle school or younger? Statistics demonstrate that high school athletes sustain an estimated 300,000 concussions per year (Marar, 2007). High school football has consistently shown in studies to be the sport with the greatest proportion of concussions with a 47.1%. High school football has the highest concussion rate (6.4 concussions per 10,000 athletic exposures) (Marar, 2007). According to the National Center for Catastrophic Sport Injury Research, there were 5 catastrophic spinal cord injuries in high school football in 2010 (Marar, 2007). This does not seem like a large number because these incidents happen in different sections of the country and at different times, but just imagine that all five of these incidents happened all at once. This would be a devastating nationwide catastrophe. The new concussion regulations are a step forward in preventing this type of situation. But in Florida one football season, and two spring seasons have passed since its implementation, and there is still some insecurities about how this law has been implemented or more so, are administrators being compliant to begin with.

One important factor of this new law is education, many of these professionals are not well informed about head injuries and how severe they can actually be. Although many head traumas exist, not all occur due to a blunt trauma. There are certain injuries that are categorized

as being caused by blunt trauma, which may include sports like football. Intracranial hemorrhages are grouped into intra-axial and extra-axial. The hemorrhage is considered a focal brain injury and occurs in a localized spot rather than causing diffuse damage over a wider area (Anderson et al., 2006). Subdural hemorrhage results from tearing of the bridging veins in the subdural space between the dura and arachnoid mater. Subarachnoid hemorrhage, occur between the arachnoid and pia meningeal layers. This injury can result either from trauma or from ruptures of aneurysms or arteriovenous malformations. The classic presentation of subarachnoid hemorrhage is the sudden onset of a severe headache. (Anderson et al., 2006)

An injury causing a significant amount of damage is a concussion. Traumatic brain injury (TBI) is an interchangeable word for concussion. This injury is a result of a blow to the head that can alter one's physical, cognitive, and emotional behaviors (Anderson et al., 2006). When a more severe concussion occurs it is associated with both anterograde and retrograde amnesia. The duration of the amnesia correlates with the severity of the injury (Anderson et al., 2006). In most cases the patients develop post-concussion syndrome, which includes memory loss, dizziness, tiredness, sickness and depression. This injury often goes undetected and for many reasons this can cause long term brain damage or even worse, death. (Anderson et al., 2006)

A concussion can be described as an acceleration/deceleration injury resulting from biomechanical forces transmitted to the cerebral tissues from impact to the head or torso (Broglio et al., 2010). A concussion is defined as a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process. (Harmon et al., 2013). There are different grades of concussions with symptoms including mental confusion, alteration of mental status, and amnesia, however, not all concussions involve loss of consciousness. After the initial

injury there is a period where there is an increased demand for glucose for cell metabolism, but at this same time a decrease in blood flow that would deliver the needed glucose. This can be dangerous if the athlete returns to play and receives a second traumatic force to the brain. The concern with concussions is that many of the symptoms will not be noticed until after the sporting event.

Athletes who have sustained multiple head injuries or traumas to the brain begin to have degenerative effects on the brain's function. In addition, concussions can create prolonged effects, be enlarged by successive concussions, or disguise underlying trauma (Starky et al., 2010). When diagnosing a concussion there is no specific anatomic measurement that can be seen. The diagnosis of a concussion is based on many factors one being the duration of loss of consciousness, if there was any. Often, there is no loss of consciousness but the athlete may see all black, all white, or stars; these athletes frequently do not realize that they have just suffered a concussion. If an athlete did not lose consciousness the way to determine if they suffered a concussion is by examining the neurophysiological findings or the immediate alterations after the impact such as, dizziness, tinnitus, nausea, memory loss, and motor impairments. These symptoms are graded from a range of total disruption to no disruption. It is very important to know your athletes simply because if there was a head injury any personality changes, fatigue, sleep disturbances, lethargy, depression, and difficulty performing daily activities can be noticed. If these delayed symptoms are noticed in an athlete it is important to intervene and evaluate them for further determination of the severity of the injury.

One of the biggest threats faced by these athletes is Second Impact Syndrome. Many athletes will not say they have suffered a concussion, or may not even know that they had a concussion. This leads athletes to return back to competition with the risk of suffering a second

concussion or second impact. Second Impact Syndrome is when an athlete who sustains a head injury, often a concussion or more severe injury such as a cerebral contusion, sustains a second head injury before symptoms associated with the first have cleared (Cantu, 1998). Second Impact Syndrome has a 50% mortality rate; quick intervention to prevent a catastrophe must be applied. Second Impact Syndrome is dangerous due to the fact that it can cause an intracranial hemorrhage; this bleeding is caused by the rupture of blood vessels supplying the brain, or by disrupting the sinus causing a separation of the left and right lobes of the brain. When this takes place it creates a large amount of pressure in the skull which can be life threatening. There are two types of hemorrhage that takes place in the brain, epidural hematoma, and subdural hematoma. An epidural hematoma which is caused by a blow to the head consists of arterial bleeding between the dura mater and the skull. The athlete may or may not lose consciousness; the symptoms appear to be those of a mild concussion. As the bleeding increases in the brain, the athlete will complain of an increasing headache, drowsiness, being disoriented, and display abnormal behavior (Kerr, 2013). In contrast, a subdural hematoma is usually venous bleeding between the brain and dura mater. This is also referred to as the silent killer, accounting for the majority of deaths in sports-related head traumas (Kerr, 2013).

A concussion is a serious matter; in 2006 a middle school football player named Zachery Lystedt was the cause of a new movement. Zachery was playing on his middle school football team, both offense and defense, and with one tackle he fell to the ground. It was reported that he did not lose consciousness but he did hold his head and rolled side to side due to the pain. Zachery was taken out of the game three plays before half-time, and returned to the game in the second half successfully. At the end of the game he collapsed on the field and had to be air lifted to the nearest hospital. Zachery underwent surgery to relieve the pressure from his brain. He

suffered multiple strokes, was placed on a ventilator for seven days, and spent three months in a coma before he finally awoke. His struggle to recovery included spending four weeks in a nursing home and two months rehabilitating in a children's hospital. It was nine months before he could speak a word, 13 months before he moved a leg or an arm, and 20 months before he was taken off a feeding tube. Zachery was lucky enough to survive however, his life has completely changed. In 2009, the state of Washington passed a new law named after Zachery to protect youth football players from suffering the same fate.

The new Zachery Lystedt Law requires medical clearance of youth athletes suspected of sustaining a concussion, before sending them back in the competition, practice or training. This law protects all youth football players under the age of 18. The law states that youth athletes who are suspected of sustaining a concussion or head injury must be removed from competition and may not return to play until he or she is cleared by a trained professional. It also states that coaches, parents, and athletes should be informed about the nature and risk of concussions, including the dangers of returning to practice or competition after a head injury. This was essentially the blueprint for the law that has been passed in all other states. The passing of this law in the state of Washington caused a domino effect of similar laws being enacted around the country. As of December 2012, a total of 42 states and the District of Columbia have passed a law similar to the Zachery Lystedt Law, including Florida. Florida passed a new law on concussions on April 27, 2012. This law takes the main objective of the original law passed in Washington State but adds specific restrictions. The law enacted stated:

An act relating to youth athletes; amending ss. 943.0438 and 1006.20, F.S.; requiring an independent sanctioning authority for youth athletic teams and the Florida High School Athletic Association to adopt guidelines, bylaws, and policies relating to the nature and risk of concussion and head injury in youth athletes; requiring informed consent for participation in practice or competition; requiring removal from

practice or competition under certain circumstances and written medical clearance to return; requiring the Florida High School Athletic Association to adopt bylaws for the establishment and duties of a sports medicine advisory committee; specifying membership; providing an effective date. (State of Florida, 2012)

In the state of Florida, if a youth football player is suspected of having a concussion they cannot return to play on the same day, and they must be cleared by a trained medical practitioner. Once an athlete has sustained a concussion or appears to have concussion like symptoms it should no longer be the role of an athletic trainer or the physician on field to clear the athlete for return to play, but rather a neurologist. This was a big change from previous years when if an athlete was suspected of having a concussion the certified athletic trainer or physician on duty would examine them and clear the athlete to return if the athlete was not exhibiting any symptoms of a head trauma. Since the implementation of the law, if the athlete is suspected of a concussion, the athlete is not allowed to play for the remainder of the day. Additionally, if an athlete's helmet comes off during a play in the competition the athlete must come off the field for a play and be evaluated for a concussion. Furthermore, the law requires all coaches to take an online concussion course. With this course coaches should be competent enough to identify concussion symptoms and encouraged to be more proactive in regards to head injuries. This sounds fairly simple and straight forward, however, since this law was implemented during spring football and before summer vacation, it is highly questionable how fast this information has reached all the parties involved and how quickly actions can be taken for its implementation. How compliant have the certified athletic trainers and coaches been since the implementation of the new law? Or has the new law been properly implemented? The aim of this study is twofold: first, the intent one is to identify if the new concussion laws in Florida were implemented correctly, and second,

to examine the awareness and compliance of the new law among coaches, athletic trainers, and athletic directors in high schools.

Statement of Problem

Tragic accidents happen in sports, but it does not mean that they should become a ritual, and cannot be avoided. Protecting our athletes and the health of our youth is very important. It should be the top priority at any sporting event to keep this possibility to a minimum, even if this means changing the game. As a society regulations and rules are implemented every day and even more so to those dealing with children. The new concussion regulations were signed and filed April of 2012 in the state of Florida, in time for the 2012-2013 high school football season. This should mean that at that time the law should have been in full effect and being executed to its full potential. However, the question is how prepared and educated are coaches, athletic directors, certified athletic trainers, and trained physicians in handling these situations as they occur. The problem lies with whether those courses are effective in educating coaches and how aware and educated are the related personnel in regards to the new regulations. Therefore, the purpose of this study is to identify if coaches, athletic trainers, and athletic directors have been compliant with the new concussion regulations as well as to identify if a sufficient job was done in enforcing these newly implemented regulations.

Significance of the Study

This study will be beneficial to high school football players as well as their families due to the fact that it will bring awareness to how safe the student athletes in high schools are in the hands of the adults who should be responsible for protecting them. The administrators in this study should all be prepared in some form to be involved in the process of when a concussion occurs: this study will identify if this is the case. If the hypothesis of this study is correct, Florida

must take measures to insure that the new regulations are truly enforced and that all individuals involved are being compliant.

Research Hypothesis

There will be differences in levels of compliance and awareness in regards to new concussion safety regulations between certified athletic trainers, coaches, and athletic directors. Certified athletic trainers will have more awareness than coaches and athletic directors on concussion laws and regulations. Results are predicted to show a lack of compliance and awareness on concussion safety according to new regulations amongst the administrators, although they are responsible for being aware and knowledgeable of concussion safety and regulations to insure the safety of all high school athletes.

Null Hypothesis

There was no significant difference between certified athletic trainers, coaches, and athletic directors on concussion safety and knowledge on newly implemented regulations. Athletic trainers, coaches, and athletic directors were knowledgeable about concussion safety that will in turn reduce the risk of catastrophic brain injuries due to concussions in high school football.

Limitations

1. Sufficient participants did not respond to the survey and a thorough consensus was limited.
2. Participants may not have answered the question to the best of their ability.
3. Participants may have acquired outside sources to answer the questions since the administration of the survey was not directly observed.
4. Football coaches' emails were difficult to acquire.

Delimitations

1. Participants were recruited from the South Florida area.
2. Surveys were administered exclusively to high school certified athletic trainers, coaches, and athletic directors.
3. Instructions on how to complete the survey were administered via email and this established participant confidentiality.

Assumptions

1. Participants received the email instructing them where to access the survey on www.surveymonkey.com.
2. All participants completed the survey administered to the best of their ability.
3. The participants adhered to the instructions given on the survey.
4. Participants understood the questions asked on the survey.
5. Participants did not seek outside sources for reference.

Definitions

Aneurysm: an abnormal blood-filled dilatation of a blood vessel and especially an artery resulting from disease of the vessel wall. ²

Anterograde amnesia: difficulty remembering events following the injury. ²⁰

Arachnoid mater: a membrane surrounding and protecting the nerves of the spinal cord. ⁷

Arteriovenous malformation: abnormal vascular connections within the brain that are presumably congenital in nature. ⁸

Concussion: an acceleration/deceleration injury resulting from biomechanical forces transmitted to the cerebral tissues from impact to the head or torso. 4

Dura mater: thick, heavy membrane that forms the internal periosteum of the skull. 3

Epidural hematoma: arterial bleeding between the dura mater and the skull. 24

ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) test: test used to identify the effects of concussion on cognitive functioning, as well as create a baseline. 23

Intracranial hemorrhage: a focal brain injury it occurs in a localized spot rather than causing diffuse damage over a wider area. 1

Pia meningeal: intimate to the surface of the brain and spinal cord and envelops the blood vessels that course along its surface. 3

Post-concussion syndrome: persistent symptoms of concussion after trauma. 24

Retrograde amnesia: difficulty remembering events that precede the injury. 13

Second Impact Syndrome: when an athlete returns back to play and receives a second concussive blow while still symptomatic from the first impact. 24

Subarachnoid hemorrhage: bleeding between the arachnoid and pia meningeal layers. 1

Subdural hematoma: a hematoma that occurs between the dura mater and arachnoid in the subdural space and that may apply neurologically significant pressure to the cerebral cortex.

Subdural hemorrhage: tearing of the bridging veins in the subdural space between the dura and arachnoid mater. ¹

Subdural space: a fluid-filled space or potential space between the dura mater and the arachnoid. ²⁷

Chapter 2

Literature Review

Concussion Testing

In high schools across the country as well as in college and professional sports, athletes are being required to take a cognitive test to create a neuropsychological baseline in case of concussion. There are many versions of these neuropsychological assessments; the most often used is the ImPACT (Immediate Post-Concussion Assessment and Cognitive Testing) test. This test is used to identify the effects of concussion on cognitive functioning, as well as create a baseline. The ImPACT test includes different sections involving memory, and reaction time. Sections involve identifying words that were shown to the athlete on a different screen, or matching the proper color with its corresponding name. The ImPACT test also helps to compare pre-season cognitive abilities with post-concussion abilities, such as memory, and reaction time. In a study by Schatz (2009), the reliability in re-testing an athlete too early for a concussion using ImPACT was investigated. They tested for a baseline measurement once a year instead of twice a year. According to this study, younger athletes from 15 years of age and younger are more susceptible to changes in brain function as well as more susceptible to sustain a concussion (Schatz, 2009). For this study the author input baseline test scores of 95 collegiate athletes that had at least two baseline ImPACT testing measures, which means the participating athletes were at least sophomores in college playing two years or more. The results of this determined that there was no significant difference between the two baseline tests. This means that there is no real reason for creating a baseline score every year for an athlete, although this study contradicts its purpose. The purpose of this study was to determine the reason for multiple

baseline test in athletes younger than 15, the participants were collegiate athletes, adults.

Therefore the findings can be suggested to support the idea that in athletes ages 15 and younger it is important to create a baseline score every year. The limitation of this study is that it included baseball, basketball, field hockey, lacrosse, soccer, and softball but it did not include football which has the highest rate of susceptibility to concussions. This study could have been affected by this limitation causing no significant difference because the sport that has the largest issue with concussions is not included.

It is important for all athletes to take the neuropsychological testing as a baseline for future injuries. However, it is the on-field evaluations that can help determine if an athlete has signs of a concussion and how severe the concussion may be. In a study by Lau et al. (2011), examined which on-field signs and symptoms would be best to determine a prolonged recovery (i.e., 21 days or more) versus a rapid recovery (i.e., 7 days or more) time. The signs that were evaluated for this study included confusion, loss of consciousness, post-traumatic amnesia, retrograde amnesia, imbalance, dizziness, visual problems, personality changes, fatigue, sensitivity to light/noise, numbness, and vomiting. For this study there were 107 male high school football athletes, whom all completed a computerized neurocognitive testing after their injury. After taking the test the athletes were monitored until a neuropsychologist cleared them to return to participation. Once cleared by the physician, athletes were grouped into rapid or delayed recovery times. The results of this study demonstrated that dizziness at the moment of injury was associated with a 6.34 odds ratio of a delayed recovery from concussion. The other signs and symptoms had no significance directly associated with an increased risk of delayed recovery in this study.

Similar to Iverson in 2007, Lau et al. examined the classification of simple and complex concussion, delayed and prolonged. The purpose of this study was to determine if high school football players that were categorized into simple or complex concussion injuries could be differentiated in the first 48 hours after the injury by just the reported symptoms and neuropsychological testing. All participants completed a computerized neuropsychological exam 72 hours after their injury; all the athletes were tracked until full recovery and return to play. The results of the study showed that 55 athletes were identified as having a simple concussion and 59 were identified as a complex concussion; this was done in relation to their recovery time. The results from this study demonstrated that within 72 hours of a concussion injured athletes with complex concussions had poorer results on the neuropsychological testing and were reported to have more symptoms than those with simple concussions. The study also showed that athletes with complex concussions who were slow to recover were 18 times more likely to have 3 unusually low neuropsychological test scores than those with simple concussions (Iverson, 2007). Furthermore, the results demonstrated that athletes with previous concussions did not recover at a slower rate than others.

Concussions have become a problem throughout all levels of competition. At the moment, much of the concentration is on high school athletes and higher levels of performance, but youth football athletes suffer injuries as well. For example, Daniel et al. (2012), investigated the head impact exposure in youth football. This study was performed by using 12 custom accelerometer array fitted inside the helmets of seven youth football players. The monitoring of the impact took place during games and practice for one full season. The data demonstrated a total of 748 impact exposures from the 7 participants; each participant had an average of 107 impact exposures. Interestingly, results showed that the highest impact levels were recorded from

practices not games. One youth football season consist of 4-5 days of practice and one game a week for about 7-9 weeks. In this time 7 youth athletes receives 107 impact exposures, that is 107 times that an athlete's brain could have possibly been injured. This is a very high number of exposures which proves the numbers given by Marar (2012), making football the sport with highest impact exposures. These minor impacts can lead to future brain damage when these young athletes become adults. This is important information, simply because if younger athletes can sustain impact exposures comparable to those of adults during practice, youths will therefore be able to do the same damage if not, worse.

In high schools, students may have anger issues and at times teammates can dislike each other, which means that if that athlete is given the chance to hit his teammate he will take it. This can be reduced or avoided by minimizing or controlling the impacts during practice. If an athlete hits too hard during practice he should be corrected, but if hard tackles are not practiced how will they be executed during a game. Is the concussion frequency occurring in high schools worth the win?

Concussions are occurring at an increasingly high rate. In a study done by William et al. (2012) a total of 544 concussions were recorded from a system used by high schools nationwide. From this data the mechanism of injury was analyzed and the most common mechanism was contact with another player (76.2%). From this section most athletes recorded to have resolved symptoms in one week. The results showed a significant difference between taking a computerized neuropsychological test and return to play. Athletes that did not have to take the neuropsychological exam returned to play within a week as oppose to those who did take the exam, which had symptoms that lasted even a month until cleared for return to play. According to Meehan et al. (2010), the study by William et al. contradicted other studies due to the fact that

it stated a greater proportion of injured, non-football athletes had computerized neuropsychological testing than injured football players. Note that this study was done at the time that Washington State became the first state to pass the new concussion regulations. This could be a reason why football players have less complex concussions, at this time many athletes would be sent to return to play if they “seemed” to be asymptomatic after only a couple of plays.

A concussion is defined as an acceleration/deceleration injury resulting from biomechanical forces transmitted to the cerebral tissues from impact to the head or torso (Broglia et al., 2010). Forces to the brain can be transmitted in numerous ways, but in football this usually occurs from helmet to helmet collisions. One would assume that with new technology athletes are more protected from injuries due to better equipment. However, it seems this is not always the case, with an increase in reported concussions, it may be possible that technology has advanced to be able to detect this type of injury at a higher rate. Broglia et al., conducted a study around the idea that understanding the biomechanical properties of concussion injury will support the development of better diagnostics and preventative techniques. For the purposes of this study all football related head impacts in 78 high school football athletes from 2005 to 2008 were monitored. Head Impact Telemetry System was used to complete this task; this is a monitoring system that was fitted in the helmets of the athletes. A total of 54,247 impact exposures were recorded, from this, 13 concussive episodes were captured to be analyzed. The study concluded that the following three factors were the highest predictors of concussion: rotational acceleration, linear acceleration, and impact location. The study stated that the threshold values achieved from the impact exposure of high school students were almost the same as the numbers for collegiate and professional football athletes. This should not come as a

surprise since these high school athletes are the future collegiate athletes and professional athletes, to them this means that in order to get noticed they must hit like collegiate and professional athletes. If the Head Impact Telemetry System were implemented for medical use, sideline personnel could diagnose one of every five athletes with a concussion when the impact exceeds these tolerance levels (Broglio et al., 2010).

Causes of a Concussion

It is crucial to learn what a concussion is and the risk associated with sustaining this type of injury. It does not happen all the time but catastrophic head injuries do occur, and one is one too many. Boden et al. (2007) updated the profile of catastrophic head injuries in high school and college football players, this way the cases are up to date and relevant. They also described what the risk factors in these injuries are. In order to complete this study 94 catastrophic football head injuries in both high schools and collegiate athletes were reviewed. From the data collected 75 athletes suffered a subdural hematoma, 10 had subdural hematoma with diffuse brain edema, 5 had diffuse brain edema, and 4 had arteriovenous malformation or aneurysm. Fifty-nine percent of the contacts noted the athlete had already sustained a previous head injury, of which 71% occurred within the same season as the catastrophic event (Boden et al., 2007). This is a large and meaningful discrepancy on the part of the staff who allowed this to occur. This study was published before the new concussion regulations were put into place; therefore it is important to realize that this shows evidence of how necessary the new laws are for the safety of youth football athletes. This study also showed that most catastrophic injuries occur in high schools, where the athletes would return to play still being symptomatic from another head trauma, being exposed to suffer Second Impact Syndrome. Although this study was published in 2007, there

was still an abundance of information on this issue to try and prevent it. These young athletes are being put in a position where they need to accept a risk that may be life changing in order to play a game. According to Thomas et al. (2011), the largest number of deaths was in football (148 [57%]), including 17 high school athletes who sustained a concussion before sustaining a fatal head trauma. The study stated that deaths in football were the most frequent for defensive players, but the most common position in football involved in these head traumas was among running backs.

Debates continue to be made whether there have been increases in concussion rates in recent years, Lincoln et al. (2011) discussed this issue in their study that was conducted during the 1997-1998 and 2007-2008 school years. In this study, 12 different sports that included both girls and boys sports from 25 different public high schools in the area were examined. Concussion injuries were identified and determined by the athletic trainer that was present at the competition. Each incident of a concussion calculated as one injury for the study. In the study it was determined that for the data collected during 1997-1998 the certified athletic trainers were part-time and typically each school had two, while in the 2007-2008 collection the certified athletic trainers were full time. This can influence the results of the study due to the fact that if the part-time certified athletic trainers were only present during games and an athlete sustained a concussion during practice it would have gone without notice. During the study no injury was reported more than once. The evaluation of repeated concussions was determined, but overall each concussion was coded as a separate injury. The results of the study involved a total of 2651 concussions and an overall frequency rate of 0.24 cases per 1000 athlete exposures. The boys' sports accounted for 75% of all concussions. Football accounted for more than half of all concussions. Among the girls' sports soccer had the highest incidence of concussion, it was

second to football overall. The overall concussion rate for boys was more than twice that for girls. The overall concussion rate increased from 0.12 per 1000 athletic exposures in 1998 to 0.49 per 1000 in 2008, which was an average yearly increase of 15.5%. Football had the highest increase in concussion rate during the time period of the study, but all other sports also had a significant increase. These results are alarming simply because as time goes by a decrease should be seen in the number of concussions in sports especially in a sport like football where protective equipment is advancing to prevent injuries. Interestingly, the study showed that after 11 years what should occur is a decrease of concussions in sports, but instead, it demonstrated that there is a continuous increase in concussion at the high school level.

Concussion Awareness

As dangerous as the sport of football can be, it is no more dangerous than any other sport like baseball or hockey. The way to resolve this issue is not by eliminating the sport, but by making adjustments and more importantly education. This means parents, athletes, coaches, and all medical staff should be up to date with all regulations and techniques to establish if an athlete has suffered a concussion. Many parents admit to not recognizing if their children have suffered a concussion, and this needs to be changed. In Canada a study was done to determine if parents of 13-14 year old hockey players were capable of determining if their child had a concussion (Coghlin et al., 2009). The parents were given a questionnaire during the children's practice. The results showed that the parents had a sufficient amount of knowledge on concussions, but mothers had a better understanding of concussions than fathers.

Williams et al. (2012), examined the perception of high school coaches toward physicians regarding concussions. From the coaches who responded, when asked about their education on

concussion, 92 of the 96 high school coaches received some form of training from either seminars or online programs. Another question involved in the study was about physician involvement. The results for this study demonstrated that 36 high school coaches stated that they refer players to the ER after a concussion, while 60 high school coaches did not. Furthermore, 38 of the high school coaches stated that they have a physician available for evaluation of a player with a concussion while 58 high school coaches did not have a physician available for a sports-related evaluation (Williams et al., 2012). The fact that 58 high schools do not have a physician available to evaluate a concussion is extremely alarming. It makes it all the more important for coaches to have some form of preparation on identifying a concussion.

The new law on concussions requires coaches to take an online course, this way they can be prepared to identify a concussion as well as be warned about the dangers of returning an athlete back to play too soon. There are different courses available like *Heads Up* and *ACTive (Athletic Concussion Training using Interactive Video Education)*; in Florida coaches can also use *Florida Hospitals Concussion Program*. A study led by Glang et al. (2010) evaluated the *ACTive* program. An online survey was sent to 75 youth football coaches across the country to be completed and returned. The results demonstrated a significant difference between coaches who experienced the program versus the control group who did not. The questions measured their knowledge in regards to sports concussion, management, and prevention; attitudes about the importance of preventing sports concussion; and intention and self-efficacy in sports concussion management and prevention. The coaches who used this program appeared to be more knowledgeable and prepared to handle a concussion.

As previously mentioned, since 2009, 42 states and the District of Colombia have established new concussion laws. The remaining states have legislation pending. Although there

are differences between the laws from state to state, the main objective is the same, protecting the athletes. The laws all include a section to require some form of education for coaches and parents. Tomei et al. (2012) compared the concussion laws between all 50 states and the District of Columbia. The study examined stipulations of concussion education, criteria for removal from play, requirements for evaluation and return to play after concussion, and individuals required to assess young athletes. The results of this study showed that all states with existing legislation support concussion education for coaches; however, only 48% require coaches to undergo formal education. Athletes must be educated on concussion in 86% of states and parents in 88.7%. Suspicion of concussion is a criterion for removal from play in 75% of states; signs and symptoms of concussion are criteria for removal from play in 16% of states (Tomei et al., 2012). The risk of having these athletes go back on the field can be fatal. From state to state the study also indicated that the person who clears these athletes varies greatly. How well are the states implementing the new concussion laws, how aware is the public of how important it is to be knowledgeable of concussions, especially coaches?

All of the above studies demonstrated the severity of concussions in football. All the studies were conducted within the past few years which means that this is a problem occurring right now. The new implementation of laws and regulations for concussion safety is a step in the right direction. But we face the question of who is enforcing these regulations and how many administrators actually know the details of what this new law requires? By the studies it is evident that there must be changes made in the realm of high school football to insure the security and safety of these children, because even if they are in high school they are still children.

Chapter 3

Methods

Participants

There were three groups selected to participate in this study according to administrative position. This inclusion criteria for this study required participants to be high school football coaches, certified athletic trainers, or athletic directors currently employed in the South Florida region. Any other administrator was excluded from participating in this survey. The survey was made available to high school certified athletic trainers and athletic directors on surveymonkey.com via email, they were asked to forward the e-mail to their corresponding football coaches. This email contained detailed instructions both on how to access the survey and how to complete the survey.

A total of 29 participants completed the survey. The majority of participants were athletic trainers (20), coaches (4), and athletic directors (5). In order to maintain the integrity of this study a Chi-square analysis was used for statistical relevance. A power analysis was performed for the use of a Chi-square analysis determining that 32 participants was an appropriate amount of participants for two groups, due to this athletic directors and coaches were placed in one group and athletic trainers were a group of their own. Percentages of participant distributions are presented in Figure 1 of the appendix.

The questionnaire consisted of four demographic questions. The questionnaire demonstrated that 90% of the participants held a full time position while 10% held a part time position. The majority of participants have been in their current positions for over six years, 52%, 21% have been in their position 1-2 years , 14% for 2-4 years, and 14% for 4-6 years

(Figure 2). In regards to the participants' presence at football practices or games, 22 participants stated attending all practices while 2 participants stated to never having attended any, and 5 attended on occasions.

Instrumentation

The survey consisted of questions regarding the participant's administrative position, the number of concussions seen in the past year, referral to physicians, and return to play guidelines. This survey was compiled from multiple articles relating to this subject. Questions were extracted from a study conducted by Coghlin et al. (2009), as well as designed around knowledge that is provided during the concussion courses. This questionnaire consisted of four sections: demographic questions, concussion regulation awareness, concussion education, and availability of physicians. The demographic questions were designed to identify the participants in the survey from the three possible career fields, as well as level of experience in this position. Concussion regulation awareness section was designed to identify the participants' level of awareness and understanding of the new concussion law. The section on concussion education was meant to develop the participants' compliance with the section of the new law that states educational concussion courses must be taken. The last section involves physician availability as well as trying to determine who these physicians are and their level of concussion training.

Procedures

In order to begin the study IRB approval was attained. The following step was to obtain the emails of the desired participants. Many of the emails for athletic trainers was obtained by a participant who wanted to support the study. The rest of the emails were obtained from different

school websites, as well as word of mouth from participants. There were three participants who filled out the questionnaire by hand, the results were later inputted into surveymonkey.com. All participants who's emailed was obtained received an email with an informed consent form. This form included information of the study, as well as contact information if they had any questions or concerns before accepting to participate in the study. Consent was implied by clicking the link and accepting to complete the survey. All participants completed the self-administered questionnaire that was made available to the high school coaches, certified athletic trainers, and athletic directors at surveymonkey.com.

Statistical Analysis

The survey results amongst the three groups were assessed and compared with one another. Each section of the survey was statistically analyzed differently due to the nature of the questions. Results from the yes/no questions were analyzed using the SPSS 20.0 version to determine which category of participants was more aware on concussion safety. In order to maintain the integrity of this study a Chi-square analysis was used for statistical relevance. A power analysis was performed for the use of a Chi-square analysis determining that 32 participants was an appropriate amount of participants for two groups. For this study $p < 0.05$ was used. Means and standard deviation for the entire survey were also calculated to understand the general awareness and compliance of concussion safety amongst the participants.

Chapter 4

Results

Concussion Regulation Awareness

The second section of the survey consisted of questions regarding the awareness of the new concussion regulations in the state of Florida. The results showed that 27 participants were informed of the new concussion regulation while 2 did not know. The two participants who stated to not knowing about the new concussion law were an athletic trainer, and a coach. Furthermore, the participants were asked to elaborate on the new regulation, where 24 participants responded while 5 participants skipped the question. All participants who answered the question gave a correct response, meaning, they all could identify at least one section of the new law. One of the more elaborate responses looked like this, “requires removal from practice or competition if signs of concussion and written medical clearance by AHCP to return to participation after completing a stepwise RTPP. Also requiring informed consent for participation in practice or competition in athletics. And also requiring guidelines to educate athletic coaches, officials, administrators, and youth athletes and their parents or guardians of the nature and risk of concussion and head injury”. While the less detailed answers looked more like this, “if you suspect a head injury athlete must be removed form play and cannot return until cleared by a doctor”. Although the main idea everyone had in their responses about the new concussion regulations are that students cannot return to play on the same day and must be cleared by a physician. In regards to the question on the participants’ opinion on the awareness of their administration towards the new regulation, results showed that 27 participants responded

yes while only 2 participants did not feel that their administrators were aware of the new concussion law.

Concussion Education

The survey also involved a section questioning the participant's education on concussion. As stated by the new law educational courses on concussion is a requirement, results showed that 26 of participants took a course on concussions, while 2 did not take any educational courses (Figure 3). Participants were asked to identify what course they acquired, when, and where. Participants had varied answers, when asked to identify the name of the course there were multiple courses listed provided by Miami Dade Public Schools, as well as different hospitals, or other programs. The majority of participants stated that they took a course in 2012, while some stated they have been taking courses since 2010 or earlier. The results of where the participants took these classes also varied a great deal, some were offered at hospitals, online, or in different high schools. When asked to identify if any of their athletes suffered a concussion to their knowledge the results showed numbers that ranged from 0-17 concussions in just one fall season (0-6: 12, 7-12: 6, 13-18: 4).

The last two questions of this section, involved information about the Graduated Return to Play Protocol. The results showed that 28 participants stated knowing what the Graduated Return to Play Protocol was, while one participant did not know what this protocol was (Figure 4). Furthermore, only 26 continued to explain the protocol. Except for one participant that did not give an explanation, all the participants answers were correct. Some answers were more detailed than others, for example, "Athletes must now follow a slow return to play. Once asymptomatic, athletes will slowly begin to participate in activities of increasing difficulty in order to determine their readiness to play. Light exertion, mod. exertion, heavy exertion, full-

contact, RTP”, other less detailed answers included, “steps taken for athlete to return to play after cleared by physician”. But they all had the right concept as to the proper way of designing and executing a Graduated Return to Play Protocol.

Availability of Physician

The last section of the survey consisted of three questions pertaining to physicians on staff available for evaluating athletes after they have suffered a concussion. The results showed that 25 of participants did have a physician available, while 4 of the participants did not have a physician available (Figure 5). Participants were given six physicians to choose from in a multiple choice question, the results demonstrated that 2 participants used a Pediatrician, no one used Family practitioners, 20 used Neurologists, 7 utilized Sports medicine doctors, 1 participant used an Internal medical physician, and 3 participants used an Orthopedist (Figure 6). The results showed that 25 of participants answered yes to the physician available for evaluation and management of concussion being trained in concussions, while 4 of participants answered no (Figure 7).

Chapter 5

Discussion

Concussions in football are currently a very “hot” topic. The National Football League (NFL) has received a great deal of controversy due to many athletes suffering concussions that went undetected causing long term brain damage. Due to the media attention that the NFL received, this trickled down to the younger athletes participating in youth football. It can be agreed upon that the primary person responsible for the safety and wellbeing of these youth athletes during participation is the athletic trainer available on staff. Following would be the coaches who should have the trust of the parents, and last the athletic director as the governing body. Therefore it should not come as a surprise that the most knowledgeable person on concussions would be the athletic trainer on staff. For this reason when Florida passed a new concussion law on April of 2012, it states that all three of the above mentioned personnel are held responsible for youth football athletes. This required coaches and athletic directors to all take an informative course on concussions. Since this new concussion law has just been recently implemented, the question at hand would be how aware are these individuals of what the law states and requires of them.

Furthermore, the purpose of this study was to identify if coaches, athletic trainers and athletic directors have been compliant with the new concussion regulations as well as to identify if a sufficient job was done in enforcing these newly implemented regulations.

Consensus/Demographics

This section of the survey consisted of the first four questions. The questions all pertained to the participant's demographic information while still keeping the survey anonymous. The participants are divided into two groups (athletic trainers and coaches with athletic directors), when doing this there was still a higher percentage of participants that were athletic trainers compared to the other group, 69% to 31%. Most of the participants were full time. The participants who stated to be part time were one athletic trainer, and two football coaches, which were the hardest of the participants to get in contact with. Many coaches tend to be part time employees at the high schools, or have other jobs besides coaching. When asked about attending practices and games only two participants admitted to not attending games all the time while in the case of practices 7 participants admitted to either never attending or just on occasions. Due to the fact that athletic directors are not obligated to attend practices, the majority of participants were athletic trainers since they are required to be at all activities including practices and games.

It was also important to identify the amount of years that the participants have been in their current position. It can be assumed that many times the longer someone is in a position they learn from those previous experiences, or they can become accustomed to a certain way of doing things not allowing them to handle change well. This can be seen many times in the older coaches who were so used to playing with concussions, believing it was nothing. The results demonstrated that over half of the participants, 51.7%, have been in their position for over 6 years, while the second largest group, 20.7%, has been in their position for only 1-2 years. This division between new and old employees is very important to note because both groups are two extremes. This information may be interpreted by in many ways, one way of seeing this information would be that one group is entering the field with no awareness of any previous

concussion regulations which means they do not know any another way to handle concussions but what is being implemented at the moment. Therefore, they would be more likely to follow the new concussion regulations word for word. While the group that have been in their position for over 6 years would be suggested to be slightly more hesitant to follow the new regulations word for word because they may have become accustomed to other procedures when handling concussions.

Concussion Regulation Awareness

In regards to new regulation awareness, out of 29 participants 2 admitted to not knowing a new concussion law had been passed. From the two participants who admitted to not knowing about the law one was a coach and the other was an athletic trainer. Although this may seem insignificant, it is troubling that two people who are dealing directly with the football players do not know about this new law. From these two participants it is a surprise that an athletic trainer does not know about this law, when they should be responsible for the safety of their athletes. Coaches should be as aware as anyone, but an athletic trainer is a health care professional who should be up to date with the latest regulations and laws. That reflects directly on the administration. Furthermore, 5 participants did not answer the question asking to explain what the law states. One possible reason for this could be the participant was unaware of what the law stated and just knew that a law was passed, or that the participant did not want to type in an answer. This would be a problem if people who are supposed to be directly affected by this law cannot identify what the law states. The results showed that two participants did not feel their administrators and athletic trainers were aware of the new concussion law.

There are no other studies at the moment with this same research but, the results of this section coincides with the results found by Tomei (2012), in which the results demonstrated that only 48% of the states with a concussion law required coaches to undergo formal education. While Florida requires coaches to undergo formal education there is no one making sure that this happens, there is no sense of urgency for these professionals to become compliant with this law. This is significant as well, because there were two participants who stated to not knowing about the concussion law at all. One of these participants was an athletic trainer, who also stated that they did not feel their administrators were aware of the new regulations. This would show a lack of communication because this new concussion law has been in effect for a year and there are people directly affected by this who still do not know that this law was passed and in full effect. But more importantly it also shows a flaw in the state to properly enforce and regulate this law.

Concussion Education

This section was completely based on section 2 (e) in the new concussion law stating “Adopt guidelines to educate athletic coaches, officials, administrators, and youth athletes and their parents or guardians of the nature and risk of concussion and head injury” (State of Florida, 2012). When participants were asked if they had taken any educational seminars on concussions, three participants stated that they did not. The participants who stated to not taking any educational concussion courses were two athletic trainers, and one coach. This would suggest that these participants are being noncompliant to the new concussion law. Yet, there are no repercussions for these participants who have not taken any concussion education. There is no set personnel making sure that everyone is being compliant with the new law which makes this law lose its value. Secondly, participants were also asked to state what, when, and where this

course was taken, and answers included “beginning of the year workshop at UHZ Sport Medicine Insitute”, as well as “University of Miami Concussion Awareness Seminar”, as well as other fluctuation in courses. Although it may be good that there are options for everyone to take a course, it also explains and shows the disorganization and lack of regulation surrounding this concussion law. The ideal way to solve this would be to create one course that everyone can take, therefore allowing everyone to be on the same page with each other. If after this course some professionals choose to go to other courses and seminars it would be extra to what is required. This was the idea around Glang et al. (2010) study in which coaches were given one course and tested before and after to see if there was a difference in their scores after taking the concussion education course. The results demonstrated that the coaches’ scores went up after taking the course provided from the study.

Thirdly, to identify if the participants where well informed from these courses the survey asked if they knew what the Graduated Return to Play Protocol was, and if yes to describe it. From 29 participants 28 stated they knew what this protocol was, but when asked to describe it only 26 answered and 3 participants did not answer the question, although in reality only 25 answered because one participant did not write anything in their answer. Most participants were correct in their description of a Graduated Return to Play Protocol. Some participants were very detailed in their answer, such as “Athletes must now follow a slow return to play protocol?. Once asymptomatic, athletes will slowly begin to participate in activities of increasing difficulty in order to determine their readiness to play. Light exertion, mod. exertion, heavy exertion, full-contact, RTP”.

When asked if any football athletes suffered a concussion to their knowledge, 26 answered yes and 3 answered no. Of the 26 who answered yes, only 24 stated an exact number of

concussions. What was more alarming were the numbers stated from participants as to how many concussions they saw within just one fall football season. The numbers presented ranged from 0-17 concussions in just one season (0-6: 12, 7-12: 6, 13-18: 4). The fact that some participants stated to having seen 13-18 concussion in just one season is very disturbing, this could mean that one athlete repeated multiple concussions or that one too many students suffered at least one concussion. This raises the question of how many concussions might have gone undetected on top of the ones that were reported. If any of those athletes suffered a concussion that went undetected returning to play could have caused second impact syndrome, which can kill them. These numbers go along with Broglio et al. (2010) study, in which 54,247 impact exposures were recorded from 78 high school football athletes. From those exposures 13 concussions were recorded, this is equivalent to what is being seen in one season by the numbers these participants stated. Many of the impact exposures in that study would not have even been noticed if it was not for the specific system implemented in these athletes' helmets, therefore imagine how hard it can be for one person to try and identify all these possible concussion episodes with the naked eye, while still treating other athletes. Although this new concussion law is helping to direct these professionals in the right direction, there are still too many grey areas. Not having all these professionals on the same page leaves room for error that can cost an athlete his life, or severe brain damage. There can be cases when the athletic trainer may not have seen an athlete receive a blow to the head, a coach should be able to determine if that athlete is at risk and inform the athletic trainer of what they saw. But if people are just going through the motions of following the regulations of the new concussion law this form of awareness and communication will not be possible. There is no uniformity to this law when it comes to the education, and can be left for personal interpretation in some areas.

Availability of Physician

The last section of the survey involved three questions pertaining to the physician on staff to clear concussed athletes. The concussion law states that any athlete who has suffered a concussion must be removed from activity and may not return to play until cleared by a physician. When participants were asked if they had a physician available for assessment and management of concussions, 25 participants stated yes while 4 stated no. Although this study is much smaller than Williams et al. (2009), the numbers can be compared. In this study coaches were asked about physician availability and out of 96 participants only 38 stated to having a physician available for concussion evaluation. This leaves room to speculate that if there is no physician available these athletes may be sent to the emergency room. In some cases when athletes are sent to the hospital they are diagnosed with a brain contusion and not as having a concussion. Many times when this happens an athlete may return to play, although this is also to the discretion of the athletic trainer when the athlete returns to play. But it must be taken into consideration that a brain contusion may be worse than a concussion. With a brain contusion the brain tissue is bruised and very fragile to any further injury. To take this previous question further, participants who answered yes were asked to identify what specialization their physician holds. Out of 25 participants who answered yes only 23 stated the specialization, although the majority of the participants, 87%, stated it was a neurologist: some participants stated that they used other specialist like pediatricians, orthopedist, and sports med doctors. One participant identified using an internal medical physician.

The last question asked if these physicians were trained on concussions in order to clear athletes, 25 participants said yes, while 4 said no. The results of these last two questions are startling: all concussed athletes should be seen by a neurologist who is a physician trained in this

form of injury. Although other physicians may be trained to clear athletes with concussions some physicians are not prepared to assess, let alone clear an athlete from a concussion. The fact that four participants stated that their physician is not trained to clear a concussed athlete is noncompliance to the new concussion law. But once again the issue with this law is that there is room for interpretation, the law states the athlete should be seen by a physician but does not specifically state it must be by a neurologist. There is no one who has answers to the grey areas surrounding this new concussion regulation, as well as no one regulation/enforcing what is stated in the law. The percentages represented in these findings are not as high as the hypothesis would have suggested but, they are still significant findings in the flaws revolving this concussion law. The numbers represent room for improvement, an athlete could have suffered second impact syndrome from returning to play after being cleared by an unprepared physician. The numbers are disturbing because these flaws can represent a youth football athlete's life at risk.

Conclusion

Concussion is a serious matter that deserves the attention of anyone involved, including athletic trainers, coaches, athletic directors, athletes, even parents. All the questions asked in this survey were designed to be very straight forward and to the point in order to obtain as many participants as possible. Since the new concussion law passed, there has been two spring football seasons and one regular season, this means that everyone should be well informed and on the same page about what is stated and required from the law. However, this study showed that up to date, not everyone involved seemed to be on the same page. Athletic trainers were the larger percent of participants for this survey, which should be the most aware and compliant with the

law yet there were still notable differences in the participants' answers which means everyone does not have the same procedures or idea about how to handle a concussion.

As for the limitations of this study, the main one is the lack of participants or a small sample size. It was very difficult to obtain the email addresses of all athletic directors but especially of coaches. There is no set database in which this contact is available, and not all school websites show this information for the staff. Another limitation related to the lack of participants is the time of year the questionnaire was sent and made available. The questionnaire was emailed to participant the first week of May 2013, this is the beginning of spring football, as well as the end of the school year. During this time many coaches can not be reached during the day, and in the afternoon they will be on the field for football practice. As far as athletic trainers and athletic directors many stop checking their email with consistency at this time of the year, as well as become busy getting paperwork and files in order for the end of the school year. The questionnaire itself is also a limitation; it was emailed and self administered creating the likelihood of receiving a large number of participants very low. The questions might not have been sufficiently clear enough for some participants and many participants may not have wanted to do the sections which required detailed writing.

There are recommendations that can be made for future research on this matter. For example, this study should be completed again, but with a larger number of participants. An attempt should also be made to make all groups the same size to evaluate awareness of concussion regulations more efficiently. Thirdly, a concussion safety seminar should be offered to participants while also having a control group that does not take the seminar. Fourthly, test each group on concussion awareness before and after to see if there is any change in their answers as well as uniformity in their knowledge of the new concussion law. These are all

recommendations that can be applied to future research given the results of this study. Although there were not a large number of participants, there were some significant findings. Athletic trainers did demonstrate be more aware than coaches and athletic directors. However, there was a lack of compliance in all groups when it comes to what the new concussion law states. Most participants lacked some form of awareness or compliance necessary to fulfill the requirements of the new concussion law. Perhaps the results of the study can help the state officials realize the problem of compliance to the new laws and regulations. If there is no reinforcement or regulation on compliance, it may be very difficult to implement a new law successfully. This is a matter of importance extreme relevance for the safety and wellbeing of our young athletes.

References

1. Anderson, T., Heitger, M., & Macleod, A. D. (2006). Concussion and mild head injury. *Practical Neurology*, 6(6), 342-357.
2. Aneurysm. 2013. In *Merriam-Webster.com*. 1. Retrieved August 19, 2013, from <http://www2.merriam-webster.com/cgi-bin/mwmedsamp>
3. Boden, B., Tacchetti, R., Cantu, R., Knowles, S., & Mueller, F. (2007). Catastrophic head injuries in high school and college football players. *The American Journal of Sports Medicine*, 35(7), 1075-1081.
4. Broglio, S., Schnebel, B., Sosnoff, J., Shin, S., Feng, X., He, X., & Zimmerman, J. (2010). Biomechanical properties of concussions in high school football. *Medicine & Science in Sports & Exercise*, 42(11), 2064-2071.
5. Cantu, R. C. (1998). SECOND-IMPACT SYNDROME. *Clinics in Sports Medicine*, 17(1), 37-44.
6. Coghlin, C. J., Myles, B. D., & Howitt, S. D. (2009). The ability of parents to accurately report concussion occurrence in their bantam-aged minor hockey league children. *Journal of Can Chiropractic Association*, 53(4), 233-250.
7. Daniel, R. W., Rowson, S., & Duma, S. M. (2012). Head Impact Exposure in Youth Football. *Annals of Biomedical Engineering*, 40(4), 976-981.
8. Geibprasert, S., Pongpech, S., Jiarakongmun, P., Shroff, M. M., Armstrong, D. C., & Krings, T. (2010). Radiologic Assessment of Brain Arteriovenous Malformations: What Clinicians Need to Know. *Radiological Society of North America*, 30(2), 483-501.
9. Gilbert, F., & Johnson, L. M. (2011). The Impact of American Tackle Football-Related Concussion in Youth Athletes. *AJOB Neuroscience*, 2(4), 48-59.

10. Glang, A., Koester, M. C., Beaver, S. V., Clay, J. E., & McLaughlin, K. A. (2010). Online training in sports concussion for youth sports coaches. *National Institute of Health: Int J Sports Sci Coach.*, 5(1), 1-12.
11. Guilmette, T., Malia, L., & McQuiggan, M. (2007). Concussion understanding and management among new england high school football coaches. *Brain Injury*, 21(10), 1039-1047.
12. Guskiewicz, K. M., Bruce, S. L., Cantu, R. C., Ferrara, M. S., Kelly, J. P., McCrea, M., Putukian, M., & Valovich McLeod, T. C. (2004). National Athletic Trainers' Association Position Statement: Management of Sport- Related Concussion. *Journal of Athletic Training*, 39(3), 280-297.
13. Hajek, C., Yeates, K., Taylor, H., Bangert, B., Dietrich, A., Nuss, K., Rusin, J., & Wright, M. (2011). Agreement between parents and children on ratings of postconcussive symptoms following mild traumatic brain injury. *National Institute of Health Child Neuropsychol*, 17(1), 17-33.
14. Harmon, K. G., Drezner, J. A., Gammons, M., Guskiewicz, K. M., Halstead, M., Herring, S. A., Kutcher, J. S., Pana, A., Putukian, M., & Roberts, W. O. (2013). American Medical Society for Sports Medicine position statement: concussion in sport. *British Journal of Sports Medicine*, 47(15).
15. Iverson, G. (2007). Predicting Slow Recovery From Sport-Related Concussion: The New Simple-Complex Distinction. *Clinical Journal Sport Medicine*, 17(1), 31-37.
16. Kerr, H. A. (2013). Closed Head Injury. *Clinics in Sports Medicine*, 32(2), 273–287.
17. Lau, B. C., Kontos, A. P., Collins, M. W., Mucha, A., & Lovell, M. R. (2011). Which On-field Signs/Symptoms Predict Protracted Recovery From Sport-Related Concussion

- Among High School Football Players?. *The American Journal of Sports Medicine*, 39(11), 2311-2318.
18. Lincoln, A. E., Caswell, S. V., Almquist, J. L., Dunn, R. E., Norris, J. B., & Hinton, R. Y. (2011). Trends in Concussion Incidence in High School Sports: A Prospective 11-Year Study. *The American Journal of Sports Medicine*, 39(5), 958-963.
19. Marar, M., McIlvain, N., Fields, S., & Comstock, R. (2012). Epidemiology of concussions among United States high school athletes in 20 sports. *The American Journal of Sports Medicine*, 40(4), 747-755.
20. McMahon, P. J. (2007). *Current diagnosis & treatment in sports medicine*. New York: Lange Medical Books/McGraw Hill Medical Pub. 183.
21. McMillon, L. (2010). *Hard Hits: Sports-Related Concussions, the Role of Certified Athletic Trainers, and Current Concussion Policy*. Honors Thesis: Ball State University. 1-15.
22. Meehan III, W. P., D'Hemecourt, P., & Comstock, R. D. (2010). High School Concussions in the 2008-2009 Academic Year : Mechanism, Symptoms, and Management. *The American Journal of Sports Medicine*, 38(12), 2405-2409.
23. Schatz, P. (2009). Long-Term Test-Retest Reliability of Baseline Cognitive Assessments Using ImPACT. *The American Journal of Sports Medicine*, 38(1), 47-53.
24. Starkey, C., Brown, S., & Ryan, J. L. (n.d.). (2009). *Examination of Orthopedic and Athletic Injuries* (3rd ed.). Philadelphia, PA: F.A. Davis Company.
25. State of Florida, Department of State. (2012, April 27). *Search | Laws of Florida*.
26. Subdural hematoma. 2013. In *Merriam-Webster.com*.
27. Subdural space. 2013. In *Merriam-Webster.com*.

28. Theye, F., & Mueller, K. (2004). "heads up": Concussions in high school sports. *Clinical Medicine and Research*, 2(3), 165-171.
29. Thomas, M., Haas, T. S., Doerer, J. J., Hodges, J. S., Aicher, B. O., Garberich, R. F., Mueller, F. O., Cantu, R. C., & Maron, B. J. (2011). Epidemiology of Sudden Death in Young, Competitive Athletes Due to Blunt Trauma. *American Academy of Pediatrics*, 128(1), 1-8.
30. Tomei, K., Doe, C., Prestigiacomo, C., & Gandhi, C. (2012). Comparative analysis of state-level concussion legislation and review of current practices in concussion. *Neurosurg Focus*, 33(6), 1-9.
31. Williams, N., Sas, A., Madey, J., Bodle, J., Scovel, L., & Edwards, J. (2012). High school coaches perceptions of physicians' role in the assessment and management of sports-related concussive injury. *Frontiers in Neurology*, 3(130), 1-4.

Appendix A

Figure 1 Participant Percentages (n= 29)

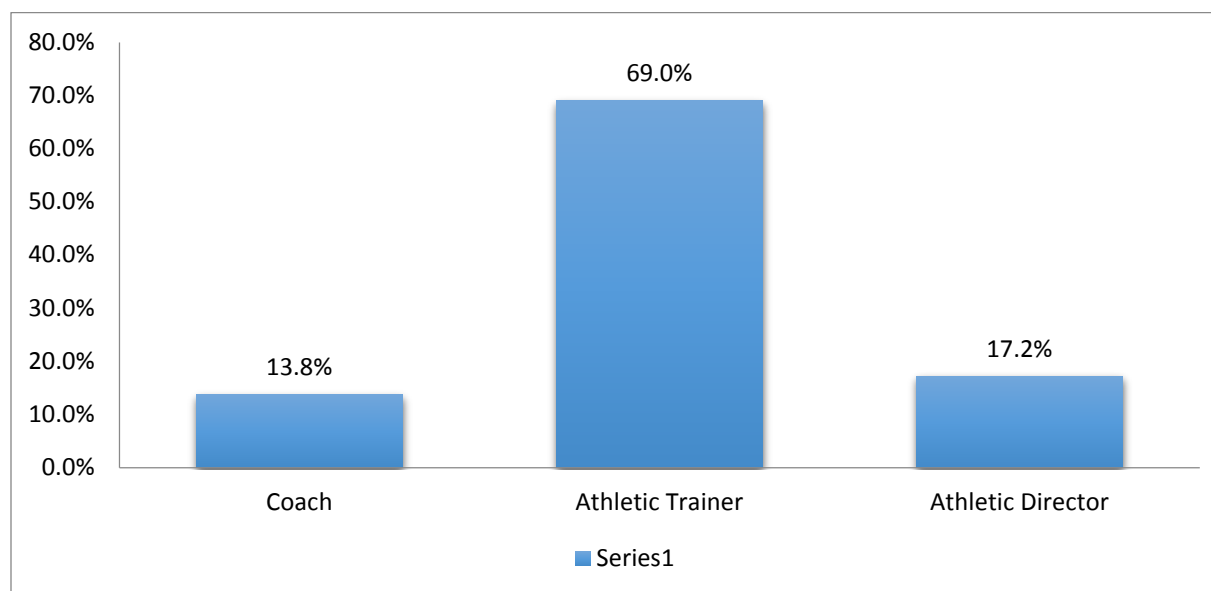


Table 1. Chi square analysis between Group 1 (athletic Trainers) and Group 2 (coaches and athletic directors).

	Total (n=29)	Group 1	Group 2	ρ^*
Groups × Awareness	29	19	10	.229
Groups × Education	29	19	10	.002
Groups × Availability	29	19	10	3.372
Groups × Concussions	29	19	10	1.534
Groups × GRTTP	29	19	10	.545

* Chi-square ($\rho < 0.05$)

Table 2. Chi square analysis between Group 1 (athletic Trainers) and Group 2 (coaches and athletic directors).

	Total (n=29)	Group 1	Group 2	ρ *
Availability \times Specialization	29	19	10	17.787
Specialization \times Training	29	19	10	17.787
Years \times Awareness	29	19	10	1.421
Years \times Education	29	19	10	1.820

* Chi-square ($\rho < 0.05$)

Table 3. Participants by Position (means and standard deviations, SD) (n = 29).

	Means \pm SD			
	Total (n=29)	Coaches (n=4)	Athletic Trainer (n=20)	Athletic Director (n=5)
Work time	1.10 \pm 0.30	1.5 \pm 0.57	1.05 \pm 0.22	1 \pm 0
Years	2.96 \pm 1.23	2.75 \pm 1.5	2.89 \pm 1.32	3 \pm 1.26

Table 4. Participants by Position (means and standard deviations, SD) (n = 29).

	Means ± SD			
	Total (n=29)	Coaches (n=4)	Athletic Trainer (n=20)	Athletic Director (n=5)
Awareness	1.06±0.25	1.25±0.5	1.05±0.22	1±0
Education	1.10±0.30	1.25±0.5	1.10±0.31	1±0

Table 5. Participants by Position (means and standard deviations, SD) (n = 29).

	Means ± SD			
	Total (n=29)	Coaches (n=4)	Athletic Trainer (n=20)	Athletic Director (n=5)
Concussion	1.10±0.30	1.5±0.57	1.05±0.22	1±0

Table 6. Participants by Position (means and standard deviations, SD) (n = 29).

	Means ± SD			
	Total (n=29)	Coaches (n=4)	Athletic Trainer (n=20)	Athletic Director (n=5)
Availability	1.13±0.35	1.75±0.5	1.05±0.22	1±0
Specialization	3.24±1.11	1±2	3.34±1.12	2.75±1.98

Table 7. Participants by Position (means and standard deviations, SD) (n = 29).

	Means ± SD			
	Total (n=29)	Coaches (n=4)	Athletic Trainer (n=20)	Athletic Director (n=5)
Training	1.13±0.35	1.5±0.57	1.05±0.22	1.16±0.40

Figure 2 Years in Position (n= 29)



Figure 3 Educational Courses (n= 29)

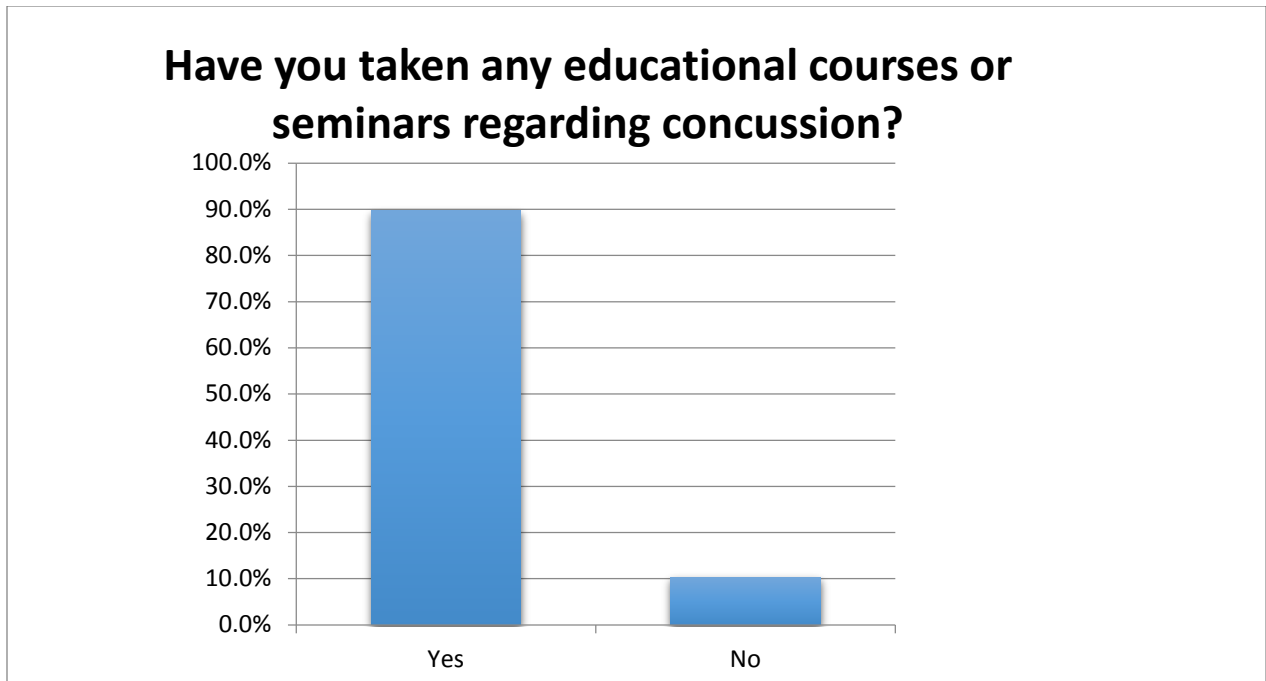


Figure 4 Graduated Return to Play Protocol (n= 29)

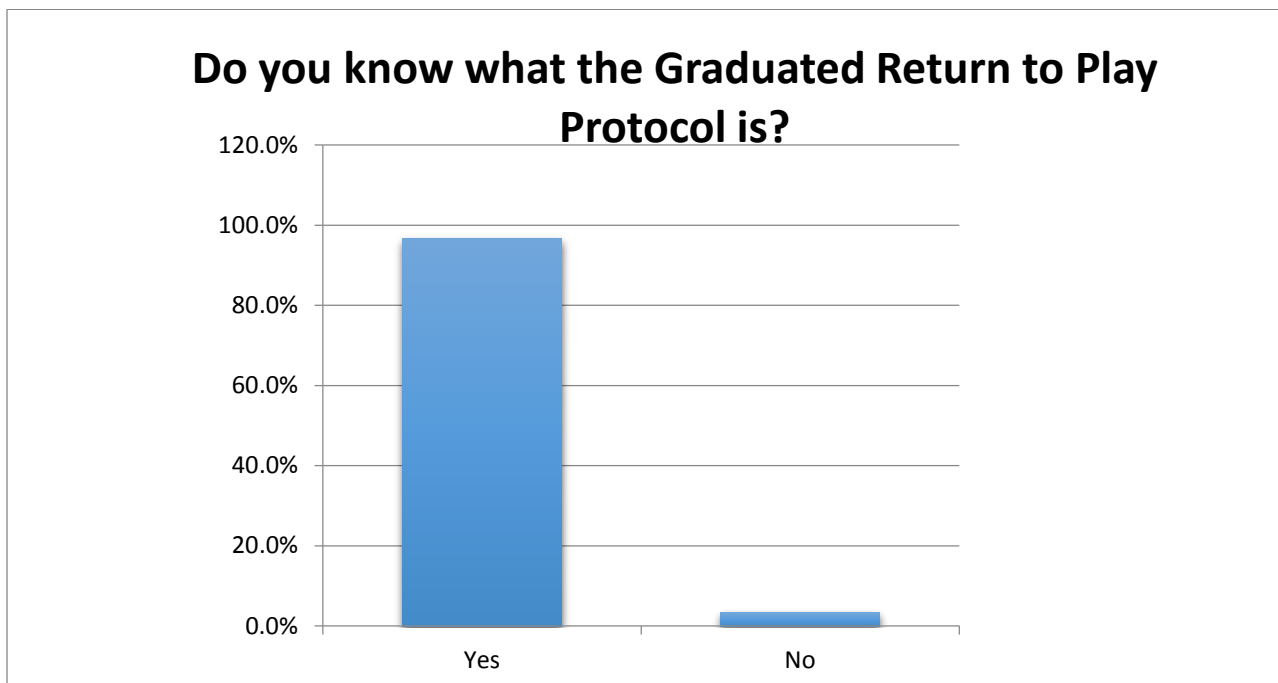


Figure 5 Availability of Physician (n= 29)

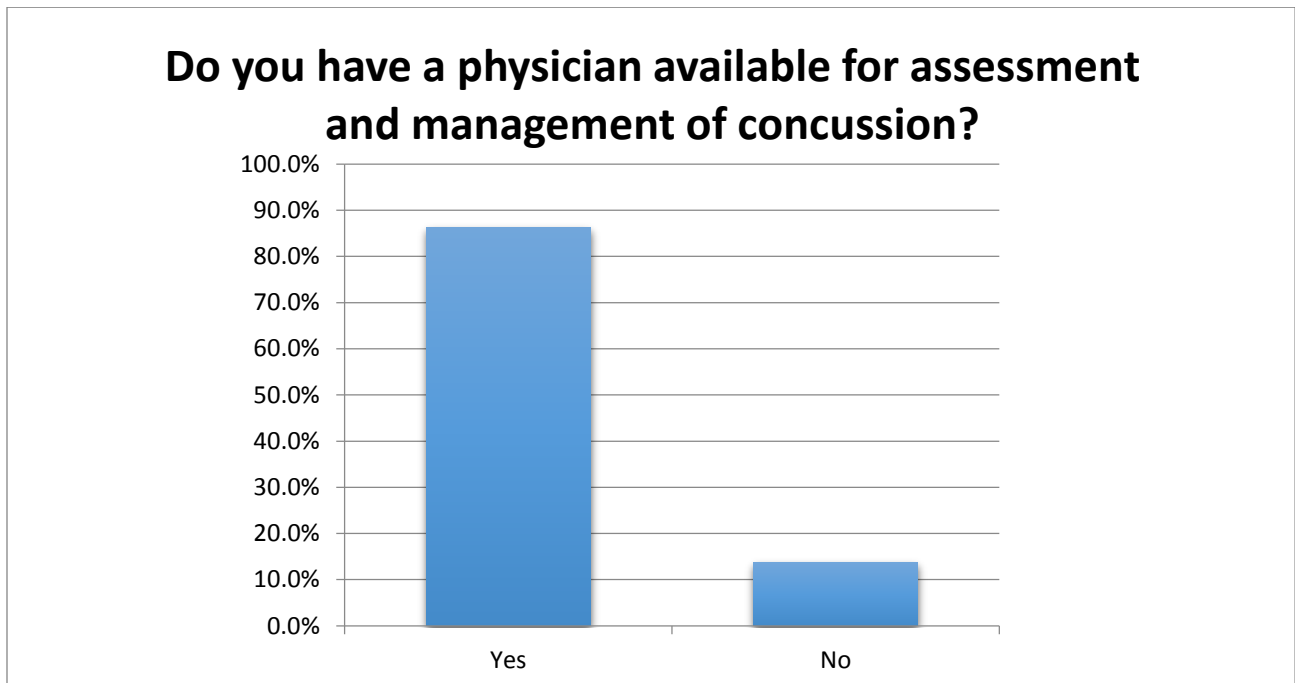


Figure 6 Physician Specialization (n= 29)

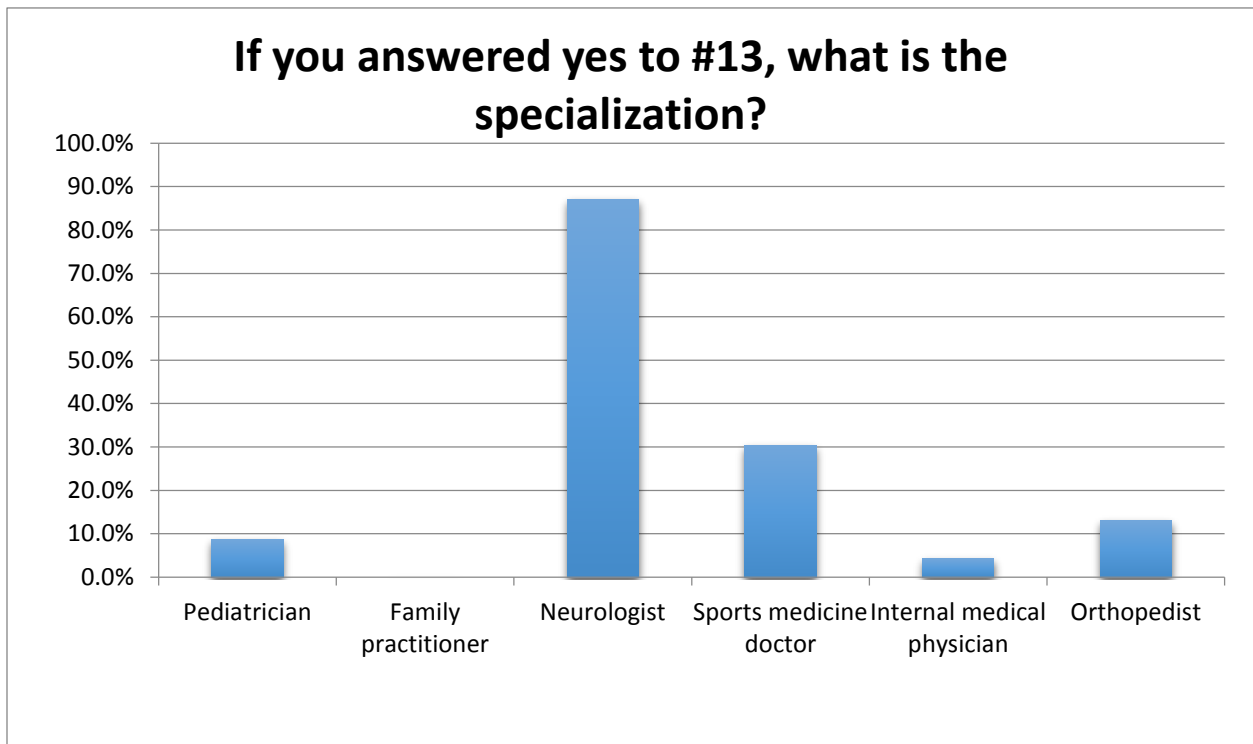
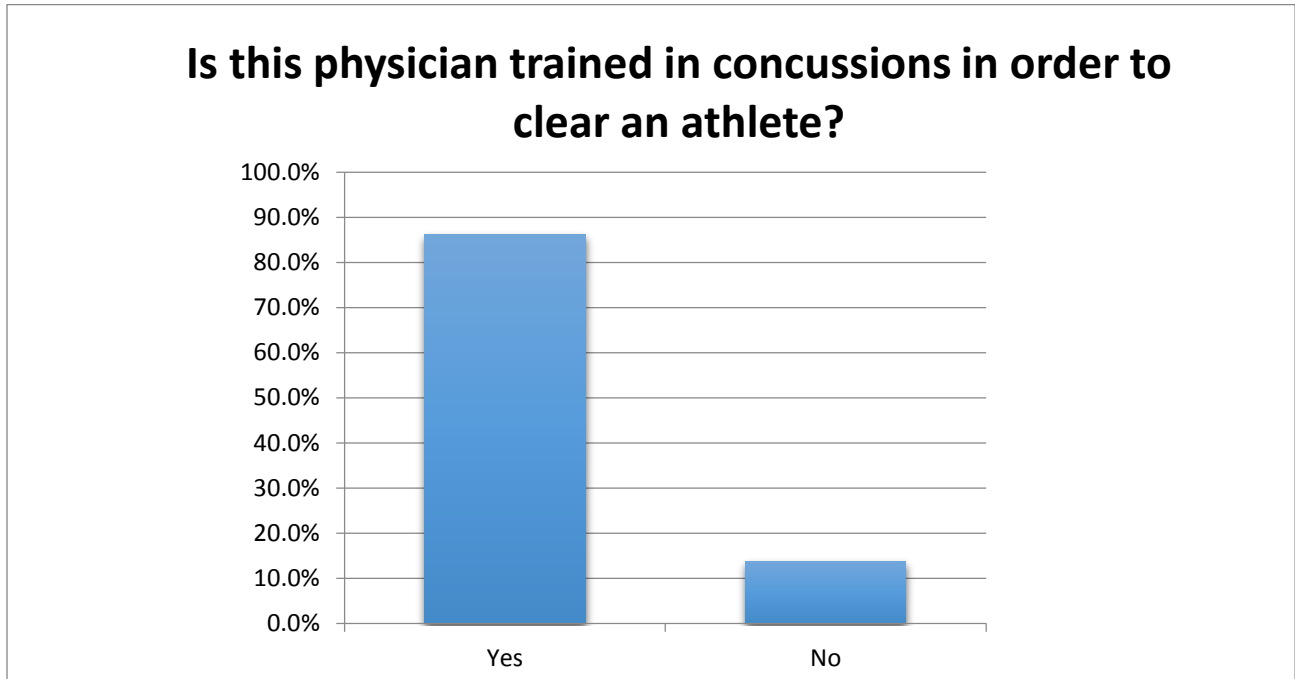


Figure 7 Trained Physicians (n= 29)



Appendix B

CONCUSSION AWARENESS QUESTIONNAIRE

Please circle one answer to each of the following question to your best ability. Note that all answers will be confidential, that is, they will not be released to anyone other than the primary investigator of the study.

Thank you very much for your participation.

1. What is your position at the institution at which you are employed?
 - a. Coach
 - b. Athletic Trainer
 - c. Athletic Director

2. Is the position full time or part time?
 - a. Full time
 - b. Part time

3. Are you present at the games or practices as well?
 - a. Games (how often: _____)
 - b. Practice (how often: _____)
 - c. Both (how often: _____)

4. Indicate the amount of years you have been working in this position?
 - a. 1-2 years
 - b. 2-4 years
 - c. 4-6 years
 - d. 6 and above

5. Are you aware that a new concussion law was passed in April 2012?
 - a. Yes
 - b. No

6. If yes, what does the law state?

7. Do you believe your administrators and athletic trainers are aware of the new concussion law?
 - a. Yes
 - b. NoIf no, why do you believe this?

8. Have you taken any educational courses or seminars regarding concussion?

a. Yes

If so, what is the course? _____

When was the course taken (year)? _____

Where was it taken and was it required? _____

b. No

9. To your knowledge, did any of your athletes from your school suffer a concussion this year?

a. Yes (How many? _____)

b. No

10. Do you know what the Graduated Return to Play Protocol is?

a. Yes

b. No

11. If yes, what is the protocol?

12. Do you have a physician available for assessment and management of concussion?

a. Yes

b. No

13. If you answered yes to #12, what is the specialization?

a. Pediatrician

b. Family practitioner

c. Neurologist

d. Sports medicine doctor

e. Internal medical physician

f. Orthopedist

14. Is this physician trained in concussions in order to clear an athlete?

a. Yes

b. No

Do you have any comments or concerns about any of the questions in this survey?

Thank you very much for your time and participation.

Appendix C

Barry University
Informed Consent Form

Dear Research Participant:

Title of Study: “Concussion Safety, Knowledge, and Awareness Among Coaches, Athletic Trainers, and Athletic Directors Regarding High School Football”.

Introduction: You are requested to participate in a research study is being conducted by Vanessa Gonzalez, a graduate student in the athletic training department at Barry University, in seeking information that will be useful in the field of concussion safety.

Purpose: The purpose of this study is to identify if coaches, athletic trainers and athletic directors have been compliant with the new concussion regulations as well as to identify if a sufficient job was done in enforcing these newly implemented regulations.

Procedure: The following procedures will be used: a survey instrument created by the primary researcher. For this study you will be asked to answer a questionnaire involving demographic questions, concussion education, recognition of concussions signs and symptoms. This survey is available through this email on a survey tool administration, SurveyMonkey.com.

Risks and Benefits: There are no potential risks to participating in this study. The potential benefits of this study are too high school football players as well as their families due to the fact that it will bring awareness to how safe the student athletes in high schools. The administrators in this study should all be prepared in some form to handle a concussion, this study will identify if this is the case.

Confidentiality: Your responses will be automatically compiled in a spreadsheet format and cannot be directly linked to you. All data will be stored in a password protected electronic format. I trust you feel confident to answer the attached survey questions as honestly as you can.

As a research participant, information you provide is anonymous, that is, no names or other identifiers will be collected. By completing and returning this survey you have shown your agreement to participate in the study. Participation is entirely voluntary and you may at any time withdraw from participation.

Questions and Concerns: If you have any questions or concerns regarding the study or your participation in the study, you may contact myself, Vanessa Gonzalez, at (305)384-8534, or may contact my academic advisor Dr. Yi-Tzu Kuo, at 305-899-4818, or the Institutional Review Board point of contact, Barbara Cook, at (305) 899-3020.

Thank you for your participation.

Sincerely,

Vanessa Gonzalez, ATC, LAT

FORM 5.9
RESULTS OF THESIS DEFENSE

Student Vanessa Gonzalez Date of Defense 9/ 27/ 2013

Major Athletic Training Specialization Movement Science

A final oral examination of the thesis toward the M.S. degree was administered. Members of the committee, their votes, and the decision are recorded below.

Committee Member	Signature	Vote
Chairperson		

PASS

FAIL

APPROVED:

Director of Graduate Programs

Submit to SES Director of Graduate Programs

Library Binding Form

STUDENT THESIS FORM

Barry University Library
 11300 NE 2nd Avenue, Room 422
 Miami Shores, FL 33161
 Attn: Suzette Sullivan

Date: _____
 No. of copies received: _____
 Customer Name: Vanessa Gonzalez
 Phone Number: 305-384-8534

Buckram Color # 990

Stamp in White:
 Stamp in Black:
 Stamp in Gold:

H & T Lines
 Single Double
 Panel Lines:
 Imprint:

NEW:
 Bound Before
 Rub Enclosed
 Sample

ADS:
 Leave In:
 Take Out:

COVERS:
 Remove:
 Bind in All:
 Bind in Front:

INDEXES:
 Front: Stub For:
 Back: No Index:

Special Instructions:

Your Spine will be lettered EXACTLY as it appears on your Binding Slip

ON THE SPINE:

Author (Last name, First Name): Gonzalez, Vanessa
 Degree (see below): Master of Science
 Year of Degree: 2013
 Barry University

ON THE FRONT COVER:

Title:

Author (First Name, Last Name): Vanessa Gonzalez, ATC, LAT
 Degree (Check One): D.Min. _____
 Ph.D. _____
 Ed.D. _____
 Ed.S. _____
 M.S. x _____
 Other: Specify: _____

School Human Performance and Leisure Sciences
 or University Honors Program _____
 Barry University
 Year of Degree: 2013

Date Shipped: _____
 Date Received: _____

PUBLISHING AGREEMENT FORM

Master's theses are primary literature. They are valuable contributions to the discourse in every field of inquiry and to the culture of all creative fields.

Publishing your Master's thesis is not a graduation requirement for the Master of Science in Movement Science or the Master of Science in Sport Management at Barry University; however, it is in your best interests to publish your thesis:

- Publishing your thesis provides you with a legitimate citation for your curriculum vitae and for other scholars who refer to your work. Otherwise, scholarly convention requires that your work be listed as an "unpublished manuscript".
- Reference to your published dissertation or thesis appears in the world's most widely used source works for graduate-level research, increasing the impact of your contribution to your field.

The purpose of this form is to obtain your signed consent to:

- Notify your thesis committee chair when you publish or present any results of the work done at Barry University.
- If you do not show proof that you have submitted your study for publication or presentation within 6 months after the thesis defense, a thesis committee member may take over the submission of this work

In the event you do submit your study for publication or presentation, the order of the authors listed for the study will be:

1st Author: Vanessa Gonzalez ATC, LAT 2nd Author: _____

3rd Author: _____ 4th Author: _____

If a member of your committee takes over the submission of your study, that committee member will move as 1st author and you will become 2nd Author.

If these arrangements meet with your approval, please sign this letter where indicated below and return it to your thesis chair.

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

Signature

Date