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# Unreported Concussion In High School Football Players

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# UNREPORTED CONCUSSION IN HIGH SCHOOL FOOTBALL PLAYERS

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# UNREPORTED CONCUSSION IN HIGH SCHOOL FOOTBALL PLAYERS

by

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THESIS

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## **Abstract**

Recent research in sport-related concussions has begun to reveal more about the specific hazards of high school football. However, the national reports of incidence/prevalence of concussions in this population appear to be inaccurate, because only emergency department (ED) visits are accounted for in reporting the number of concussions sustained in football. **Purpose:** The purpose of this study was to investigate whether there is a statistically significant difference between the frequencies of concussion reports by athletic trainers (ATC) versus hospital records on concussion in high school football players in El Paso, Texas. **Method:** A questionnaire was delivered to athletic trainers through face-to-face interactions in El Paso, TX and admission reports were collected from all participating hospitals in the city for comparison. **Results:** There was a statistically significant difference between concussions reports, more by athletic trainers than the number of hospital ED reports with a diagnosis of a concussion. Fifty-five percent of the concussions reported by athletic trainers were not admitted to a hospital, and 24% did not receive any medical attention.

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## **Chapter 1: Introduction**

American football has a remarkable history and tradition of athleticism that appeals to both fan and player alike. Within the past decade research dealing with sports-related concussions has exposed the long-term effects, risks, severity, and incidence of concussions. Unfortunately, current statistical data reported in the literature and online resources is problematic. The reported estimate of 300,000 sport related traumatic brain injuries annually by the Center for Disease Control and Prevention includes cases in which the patient experienced a loss of consciousness (LOC) and was admitted to the emergency room (ER). “Published estimates of the incidence of TBI in the United States are dated, and have usually been limited to community studies of hospitalized patients, fatalities, or both” (Sosin, Sniezek, and Thurman, 1996, p.2). The national estimate provided does not account for the widespread incidence of concussion, due to the exclusion of athletes who did not visit the ER. The reported data and statistics in the current research and literature are retrieved from hospital reports, but hospitals admit severe head injuries and rarely, if ever, address mild concussions sustained in athletics. In order to address this discrepancy in concussion incidence, a closer look at who manages and evaluates concussions will provide a more accurate rate of concussions managed in football. For example, the reports of athletic trainers can be compared to hospital ER admissions.

If a collision results in an incapacitating blow to a player's head, it is on the field or sideline where athletic trainers identify the suspected concussion. A concussion; also known as a mild traumatic brain injury (mTBI), is defined as a blow or jolt to the head or body that causes the brain to move rapidly inside the skull (CDC, 2007; ImPACT, 2006). In the hospitals, according to the International Classification of Diseases (ICD), a concussion is classified as a “violent jar or shock, or the condition which results from such an injury” (p1.), and the

subsequent codes describe a concussion at different levels (Table 1). The incident of a concussion is rarely referred to the local emergency department (ED), although players may be referred in cases of immediate life-threatening injury. The current system of concussion evaluation relies on athletic trainers to diagnose a concussion, and it is precisely these concussions that are not accounted for in national datasets.

<b>Table 1:</b> International Classification of Diseases concussion definitions.	
<i>DRG Code</i>	<i>Definition</i>
<b>850</b>	A violent jar or shock, or the condition which results from such an injury
<b>850.0</b>	Concussion with no loss of consciousness
<b>850.1</b>	Concussion with brief loss of consciousness
<b>850.11</b>	Concussion with loss of consciousness of 30 minutes or less
<b>850.12</b>	Concussion with loss of consciousness from 31 to 59 minutes
<b>850.2</b>	Concussion with moderate loss of consciousness
<b>850.3</b>	Concussion with prolonged loss of consciousness and return to pre-existing Conscious level
<b>850.4</b>	Concussion with prolonged loss of consciousness without return to pre-existing conscious level
<b>850.5</b>	Concussion with loss of consciousness of unspecified duration
<b>850.9</b>	Concussion unspecified A violent jar or shock, or the condition, which results from such an injury.

According to Iverson, Gaetz, Lovell, and Collins (2004), there are at least 1.25 million athletes who compete in contact sports at the high school level. At this level of play there are approximately 62,816 cases of concussions annually, with 63% occurring in American football (Powell and Foss, 1999). Few studies have attempted to report the incidence of concussion in

this population and a reliable figure has yet to be established. The different studies that do report an incidence only provide an estimated percentage of how many concussions are occurring, specifically for adolescents from ages 14-19 years old (McCrea et al, 2004; Powell & Foss, 1999; Collins et al, 1999, Iverson et al, 2004). It is important to recognize the underreported number of concussions in high school athletes due to overwhelming evidence showing that recurrent head injuries can result in (1) post-concussion syndrome, (2) longer-lasting symptoms, and (3) late-life cognitive impairments (Collins et al., 1999; Iverson et al, 2004; Covassin et al., 2008; Guskiewicz et al., 2006). In general, the consequence of unreported concussion and unidentified concussion in adolescents is crucial (McCrea et al., 2004). The misrepresentation of concussion incidence in high school football players can be contributed to hospital reports, definition of concussion, and knowledge and recognition of a concussion.

#### *Definition of concussion*

To date, a standard definition of concussion has not been created. It was first held that a concussion had to involve loss of consciousness (LOC), when in fact, more than 90% of sports related concussions result in no LOC (McCrea, 2001). One of the contributing factors to lack of accurate incident rates among concussions is this lack of agreement on defining what a concussion is.

The CDC is one of the most relied on sources for reports of all injuries. They include concussion, but their definition for TBI is based on a surveillance system designed to identify cases of TBI (at all severity levels) that result in hospitalization, cases which tend to be more severe. In the state of Texas there are guidelines by the University Interscholastic League (UIL) that athletic trainers must follow for all school sports and recreational activities. The UIL defines

concussion as a “traumatic brain injury when an outside force impacts the head hard enough to cause the brain to move within the skull or... causes the skull to break and directly hurts the brain.” (p 2.). The following Tables (2,3) highlight the most commonly occurring terms among concussion definitions, and it is evident how, although each definition highlights similarities, variability still exists among definitions.

<b>Table 2: Concussion defined within commonly used scales.</b>	
Scale Name	Definition
SCAT – Standardized Concussion Assessment Tool	Sports concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathological and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury
ImPACT – Immediate Post Concussion Assessment and Cognitive Test	A concussion is a disturbance in brain function that occurs following either a blow to the head or as a result of the violent shaking of the head.
AAN – American Academy of Neurology	Concussion is a trauma-induced alteration in mental status that may or may not involve loss of consciousness. Confusion and amnesia are the hallmarks of concussion.
GCS – Glasgow Coma Scale	Assessment of gross neurologic status across three core areas of motor function, verbal reasoning, and the patient’s ability to open the eyes voluntarily or in response to external commands and stimuli.
CDC Heads Up – Center for Disease Control and Prevention	A concussion is a type of traumatic brain injury, or TBI, caused by a bump, blow, or jolt to the head that can change the way your brain normally works. Concussions can also occur from a fall or a blow to the body that causes the head and brain to move quickly back and forth.
SAC – Standardized Assessment of Concussion	Concussion is a trauma-induced alteration in mental status that may or may not involve loss of consciousness. Confusion and amnesia are the hallmarks of concussion.
UIL – University Interscholastic League	Traumatic brain injury when an outside force impacts the head hard enough to cause the brain to move within the skull or if the force causes the skull to break and directly hurts the brain.

**Table 3:** Common terms used in defining concussions among the different scales (derived from Table 2)

<u>Scale Name</u>	Patho-physiological	Blow to head	shaking of the head	Acceleration/ deceleration	Trauma induced	Mental status	Type of TBI	Back & forth (head)	LOC (+/-)	Confusion	Amnesia
SCAT	X	X	X	X	X	X		X	X	X	
Impact		X	X			X					
AAN		X			X	X			X	X	X
GCS						X					
CDC Heads Up		X	X			X	X	X			
SAC		X			X	X			X	X	X
UIL		X	X	X				X			

The Summary and Agreement Statement of the 2<sup>nd</sup> International conference on Concussion in Sport held in Prague (McCrorry, P., Johnston, K., Meeuwisse, W., Aubry, M., Cantu, R., Dvorak, J., Graf-Baumann, T., Kelly, J., Lovell, M., & Schamasch, P., 2005) advanced the concept of simple versus complex concussion. The two are differentiated according to duration of symptoms: simple, lasting less than 10 days and complex lasting over 10 days. This concept was analyzed further in 2009 by Makdissi, who provided a detailed review of how this proposed classification system may or may not be of clinical value and use, as well as identifying the shortcomings of the classification system. In conclusion Makdissi states, “until further information about the pathophysiology of injury, prognostic factors for more severe injuries and risk factors for poor outcome is known, concussion in sport should be considered as a single entity.” (p. 126). The researcher concluded that the system lacked prognostic markers of severity, did not include intervention recommendations for simple concussions, and could not produce prognostic markers or intervention recommendations until recovery was reached. The

3<sup>rd</sup> International Conference eventually abandoned the classification of simple versus complex terminology when referring to concussion because “it does not fully describe the entities” (McCrory et al., 2009 p.341).

At the 3<sup>rd</sup> International Conference on Concussion in Sport held in Zurich (MrCrory, P., Meeuwisse, W., Johnston, K., Dvorak, J., Aubry, M., Molloy, M., & Cantu, R., 2009), the panel came to a consensus on defining concussion:

“Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury... (Lists 5 descriptions)” (p.341)

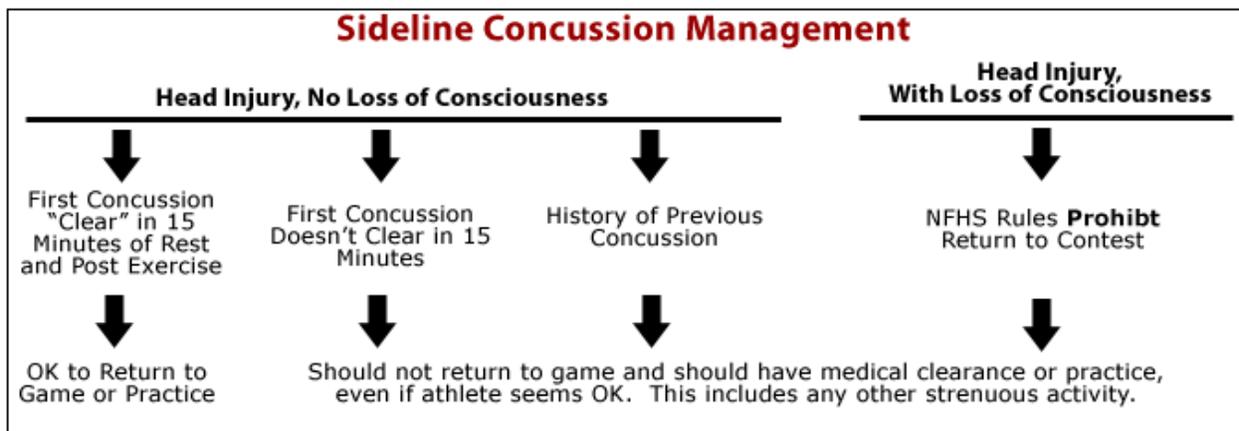
Together with a definition, the panel generated an in-depth description of every factor to note when an injury is sustained, such as history of concussion, symptoms, behavior, and balance. This 3<sup>rd</sup> conference identified the importance of concussion management, of risk in special populations, return-to-play protocols, and other aspects of concussion. But, it still relies upon the use of scales and this panel has yet to put forth a strict adherence to one definition of concussion. (Field, et al, 2003; McCrea et al, 2003; Iverson et al, 2006; Echemendia et al, 2001).

### *Scales of Severity*

If the severity level of a traumatic brain injury (mild, moderate, severe) warrants the medical attention received, how are these levels classified? To date, there has been over 35-concussion severity scales published; yet none have been scientifically validated (Johnston, McCrory, Mohtadi, & Meeuwisse, 2001). McCrea (2008) reports ten different scales, such as the American

Academy of Neurology, Cantu Grading System, and the Glasgow Coma Scale. These classification scales are rated along severity from mild, moderate, and severe which fall into a grading system (3 grades). In the state of Texas the UIL also provides their own scale to use in assessing concussions. Furthermore, these guidelines provided by the UIL are enforced among employed athletic trainers.

Recently the UIL has been under scrutiny because of two reasons; (1) they provide a set of recommendations and not a policy and (2) the current guidelines allow an athlete to return to play on the same day if the athlete hasn't lost consciousness and concussion symptoms have resolved within 15 minutes. The UIL provides a schematic (figure 1) for athletic trainers (and coaches) to follow when assessing concussions, which clearly states returning to play if symptoms resolve after 15 minutes. Of the many scales used, no other states return to play within this time period.



**Figure 2:** UIL Sideline Concussion Management Schematic, (University Scholastic League, 2011)

The use of various scales and definitions of concussion make it difficult for professionals to come to a consensus in defining and reporting, or documenting concussions. Many athletic trainers do not use set criteria when evaluating an injured athlete. Oliaro, Anderson, and Hooker

(2001) state that up to 63% of ATCs report **not** using any scale when evaluating concussion.

Although many of these scales are similar in various aspects, it is important to “define and have a set criteria because there is a significant impact on the eventual interpretation of findings on acute effects, recovery, treatment response, functional outcome, and prevalence of disability following mild traumatic brain injury” (McCrea, 2008 p.24).

The use of scales as well as the different definitions of concussion can be a contributing factor to the scarcity of concrete data on the frequency of concussions in high school athletes. The 1<sup>st</sup> International Conference of Concussion in Sport in Vienna (Aubry, M., Cantu, R., Dvorak, J., Graf-Baumann, T., Johnston, K., Kelly, J., Lovell, M., McCrory, P., Meeuwisse, W., & Schamasch, P., 2001) highlighted the strengths and weaknesses of the existing scales but did not endorse any one in particular. However, attendees during the course of the conference agreed to “make a comprehensive, systematic approach to concussion injury to be of potential benefit to aid the injured athlete and direct management decisions. (p.4)” They produced one production protocol with the statement that revision will take place as literature and research brings more information to light.

### *Statistics*

The incidence rate of concussion is highly dependent upon the data’s source. As stated above, the national statistics of concussion incidence provided are retrieved from ED visits, and each diagnosis is determined by the level of its severity. A CDC report in 2007 analyzed data from the National Electronic Injury Surveillance System (NEISS), which retrieves injuries labeled as concussions directly from hospitals. In 1991, 20% of the 1.5 million TBIs in the United States were accounted for as sport related injuries. Of the 306,000 cases, only 12% were hospitalized, 55% received outpatient care and 34% received no medical care (Sosin, Sniezek, &

Thurman, 1996; Thurman, Branche, & Sniezek, 1998). Furthermore, in 1999 Thurman and Guerrero investigated the trends in hospitalization associated with traumatic brain injury. Their findings revealed a decline in reported injuries of mild severity. The “estimated rate of TBI related emergency department visits in 1992-1995 (approximately 1 million cases each year in the US) indicates that about 80% of persons now evaluated for TBI are not admitted to hospitals. (p.4).” If 80% of these injuries are not admitted, reports that derive their information from only hospital visits do not account for the majority of the injuries seen.

The latest CDC report in 2007 analyzed data from the NEISS to report incident rates of emergency department visits from 2001-2005. These reports indicate that children and youth between the ages of 5-18 accounted for 2.4 million sport related concussions. The highest ED visits were youths between 10-14 years old, followed by the 15-19 year old age category, with males accounting for 70.5% of the diagnosed traumatic brain injuries (TBI). NEISS further states that 15-24 year old athletes form the second leading population of diagnosed traumatic brain injury. Furthermore, Bakhos, Lockhart, Myers, & Linakis (2010) recently provided a report on emergency department visits for concussion in young child athletes. They report that adolescents’ ages 8-13 years had an estimated 502,000 ED visits for concussion, and football was the leading sport in which these injuries occurred (49%). This data reveals a trend of increasing incidence rate, but according to ED visits only. This data also emphasizes the age groups in which incident rates for concussions are more prominent, and growing.

In 2008-2009 academic year Meehan, d’Hemecourt, and Comstock (2010) produced a report of the concussions recorded by High School Reporting Information Online (HSRIO) surveillance system nationwide, stating that in one year, 544 concussions were recorded. Their data was collected by recruiting athletic trainers and having them track the number of injuries

and record them on the online surveillance system. Of the concussions recorded, 28% occurred in 16-year-old athletes, in which 51.7% occurred in varsity players. In Texas, there are approximately 1,139 high schools with football teams. It is estimated that the number of participants in high school football in the state of Texas is approximately 165,000 (University Interscholastic League, 2008). In 1989 all injuries were recorded in the state of Texas in high school football, but in this report concussions were not directly addressed (DeLee and William, 1992). The participation of schools represented 4,399 athletes in football, and a total of 2,228 injuries were reported; 111 (5%) injuries were classified located to the 'head' and types of injury classified as concussion were 101 (5%). It can be estimated from these numbers that among Texas football players it is possible that currently of the 165,000 athletes in Texas, 4,125 will sustain a concussion during a single season.

The statistical differences between concussion rates vary from study to study. Guskiewicz, Weaver, Padua, and Garrett (2000) reported that high school athletes sustain a higher rate of concussions as compared to college athletes, high school athletes at 5.6% (similar to Powell and Foss (1999) at 5.5%). A similar study by Gessel, Fields, Collins, Dick, Comstock (2007) reported an occurrence of 8.9% of all high school sport-related concussion. These inter and intra-study contrasts may be attributed to relative levels of skill and injury avoidance by the more experienced collegiate football players, differences between training practices of high school compared to university athletics, or even the different levels of game officiating and refereeing. Some studies complement each other and some contradict one another in regards to the incidence of concussions in high school athletes. Bakhos et al (2010) demonstrated in a 10 year span that emergency department visits for concussions in 8-13 year olds doubled and in 14-19 year olds increased by >200%.

### *Adolescent Athlete*

Concussions have been the hot topic at all levels of play (professional, college, high and middle school), and all populations are at-risk, yet “it is unclear how the ongoing brain development that occurs throughout childhood affects a child’s susceptibility to concussion” (Kutcher & Eckner, 2010, p.17). Patel and colleagues (2005) suggest that high school football players fail to comprehend the significance of the immediate and long-term consequences of brain injuries and may be less forthcoming in seeking medical attention and adhering to treatment recommendations when having sustained a concussion. As evidenced by McCrea et al.’s (2004) questionnaire which sought to estimate the frequency and history of previous concussion in high school varsity football players. The researchers surveyed 1,532 high school football players to investigate (a) the reasons why athletes did not report a concussion, (b) to whom an incident was reported, and (c) the number of concussions sustained before and during the season. The responses provided by the athletes made it evident to the professionals that these players are not well informed of concussions overall. Some players indicated on the questionnaire that they did not report a concussion because “it was not serious enough”. Lack of knowledge was the most common reason for not reporting a concussion to anyone. When the researchers provided an operational definition of concussion to the athletes, “the athletes then readily recognized and admitted to having experienced a concussion” (p.15). Furthermore, when the athletes were asked to whom they report their concussion results revealed that the athletic trainers were the professionals most frequently called on by the athlete to evaluate and manage a concussion. McCrea’s study on reported and unreported concussion also reflects a higher prevalence of concussion among high school football players than that of the national data numbers. Their research indicated that in each season, there is a 15% occurrence of concussion,

providing more evidence to support the hypothesis that incidence reports of concussions in high school football players based on ED visits may be misleading.

<b>Table 4. Concussion Reporting Data*</b>			
<b>Concussion reported to:</b>	<b>Percentage of Subjects (n=1,532)</b>	<b>Why Concussion not Reported</b>	<b>Percentage of Subjects (n=1,532)</b>
Certified Athletic Trainer	76.7%	Did not think it was serious enough	66.4%
Coach	38.8%	Did not want to leave the game	41.0%
Parent	35.9%	Did not know it was a concussion	36.1%
Teammate	27.2%	Did not want to let down teammates	22.1%
Other (e.g., family physician, student)	11.7%	Other Reasons	9.8%

\*Categories are not mutually exclusive; subjects were asked to check all that apply. – McCrea et al, 2004

High school athletes range in age from 14-18 years old. Neuro-physical development is still occurring in athletes within this age range. Throughout this time adolescents are growing and are on a learning acquisition curve that can be easily disrupted by experiencing a concussion, and worse yet, prevents a concussion from resolving. Within the last five years, scientists have discovered that adolescent brains are far less developed than previously believed. Micheli and Purcell (2007) state, “in the case of traumatic head injuries, especially concussions, adolescent athletes have unique pathoanatomical and clinical characteristics” (p 2330). Athletes do not realize that physical development during adolescence may affect the nature and severity of injuries (Patel et al, 2005). Impact can interrupt the maturation of neuronal development and the development of cognition (McCrory, Collie, & Davis, 2004). Researchers from The National Institute of Mental Health (NIMH) have used MRI to study the adolescent brain and its development, concluding, “the teen brain is not a finished product, but is a work in progress (ACT for Youth upstate center of Excellence Cornell University, 2002 p.1).”

Furthermore, there is a process referred to as neuronal ‘pruning’ that is taking place during these young ages. Pruning is described by researchers at the Juvenile Justice Center (2004) as a process similar to pruning a tree; cutting back branches stimulates health and growth. This process of neurons being ‘pruned’ continues into early 20’s and can be disrupted if a concussion is sustained. Kirkwood, Yeates, and Wilson (2006) provide a review on management in pediatric/adolescent sport related concussion, highlighting the differences between an adolescent and adult. Table 5 summarizes the comparisons researchers addressed in their review, emphasizing how younger athletes may respond more poorly to a concussion and why this population of young athletes warrant attention management of concussion injuries. Dennis and Levin (2004) affirm that after damage to the immature brain, plasticity for recovery co-exists with plasticity for development, and both contribute to long-term cognitive outcome. It is prevention of post-concussion syndrome and/or second-impact syndrome that becomes the concern in high school athletes.

**Table 5:** Summary of adolescents sport related concussion effects, Kirkwood et al, 2006

<b>Levels</b>	<b>Adolescent</b>	<b>Effects</b>
<b>Biomechanical</b>	- Immature musculoskeletal system, less well-developed neck and shoulder musculature	- Inability to transfer energy directed at the head throughout the body
	- Diminished size & strength, lower force/mass ratios	-Characterize their collision (different levels of play)
<b>Pathophysiological</b>	-Pathophysiological cascade differs in developing brain	- Incidence of brain swelling & cerebral edema after moderate-severe brain injuries is higher in children
	-Physiologic responses are age-dependent after mTBI	-Second-impact syndrome, seen in adolescents
<b>Neurobehavioral</b>	-“Kennard principle”	- Young brain’s plasticity allows for more recovery
	-Immature brain is more vulnerable	- Skills not yet established at time of insult could be more susceptible to disruption than well-established ones
	-Recovery is less positive	- Evidence by neuropsychological testing
<b>Contextual</b>	-Continually expected to acquire new info and skills; use of neurobehavioral skills	- Ability to focus and sustain attention, rapidly process information, and hold information are vulnerable
	- Parent/legal guardian responsible for medical decisions	-Access to professionals outside the family, is there adequate knowledge?

*Potential Risks*

The cumulative effects, risks, and recovery rates after sustaining a concussion vary within athletes. If an athlete does not report a concussion the risks of ongoing symptoms and cumulative effects increases. Athletes that sustain a concussion experience a variety of symptoms, the most common including headaches, dizziness, blurred vision, sensitivity to light, and noise (Cernich et

al., 2007). The most salient issues with regard to symptomatology include second-impact syndrome (SIS) and post-concussion syndrome (PCS). SIS occurs when an athlete has returned to play before the symptoms of the current injury have resolved (McCrory & Berkovic, 1998) and a second concussion occurs, which may even be fatal. According to Echemendia and Julian (2001), a slight second head injury can result in severe disability. PCS, on the other hand, is an impairment of cognitive functioning that affects neurobehavioral symptoms for an extended period of time, months and possibly years after (Hall, Hall, & Chapman, 2005). Jotwani and Harmon (2010) define PCS in athletes as, “the persistence of cognitive, physical, or emotional symptoms of concussion for a time frame longer than normally would be expected” (p.22).

The research in cumulative effects and post-injury symptoms/characteristics must be taken into consideration. Iverson, Gaetz, Lovell, and Collins (2004) examined the possibility that athletes with multiple concussions present cumulative effect of injury. Utilizing Immediate Post-Concussion Assessment and Cognitive Test (ImPACT, Iverson et al., 2003) amateur athletes with three or more concussions, complete data, and baseline scores were selected to participate in the study. The sample of 19 athletes (11 high school, 8 college) with a history of concussion was matched with a sample of 19 athletes with no prior concussions. The findings of the research indicated that young athletes who sustain multiple concussions reported significantly more symptoms and demonstrated a trend toward lower memory scores at baseline. The researchers also provided preliminary and stimulating evidence suggesting that young athletes with multiple concussions might have cumulative effects that include memory decline, and persistent symptoms.

For example, Lovell, Collins, Iverson, Field, Maroon, Cantu, Podell, Powell, Belza, and Fu (2003) performed the first study that compared acute neurocognitive recovery after sports-

related concussion in concussed and non-concussed high school athletes. The researchers collected pre-season baseline data from 64 concussed high school athletes and 24 non-concussed high school athletes (comparison group) using the ImPACT test battery. Lovell and colleagues excluded athletes who experienced any degree of post-injury loss of consciousness and instead focused on athletes with varying degrees of symptoms, including disorientation, post-traumatic and retrograde amnesia. After an athlete sustained a concussion he was given follow-up neuropsychological evaluations at 36 hours, 4 days, and 7 days post-injury. Their results demonstrated a pronounced memory decline in some concussed high school athletes that remained at least 7 days post-concussion after having suffered a mild concussion. There was also a mismatch of self-reported symptoms and the performance on memory tasks; athletes reported their symptoms to have resolved 4 days post-concussion whereas their memory decline lasted longer. The researchers state the importance of implementing neuropsychological tests in high schools because the primary determinant of an injury relies on self-reports that have poor reliability. They concluded that the use of neuropsychological tests provided unique information to the professional managing athletes who sustain a concussion.

A similar study compared recovery rates of college athletes and high school athletes (Field et al, 2003). The participants were 371 college athletes and 183 high school athlete (161 football players). All the athletes participated in a Concussion Safety Program and neuropsychological tests pre-season: college, 1997-1998 through 2000-2001, and high school 1999-2000 and 2000-2001 football seasons. If an athlete sustained a concussion they were referred for post-concussion evaluations after 24 hours, 3, 5, and 7 days of injury. The study revealed that high school athletes demonstrate slower acute neuropsychological recovery after

sports-related concussion when compared with college athletes. After a mild concussion, high school athletes displayed significant memory impairment at least 7 days after injury.

The researchers also recommend the use of neuropsychological tests because reliable measures are provided that allow for comprehensive assessment, features that an MRI or PET scan do not offer. The panel in Zurich (McCroory et al., 2009) also acknowledged the use and value of neuropsychological testing in concussion. Currently science has not identified metabolic markers that can distinguish a concussion, therefore the use of neuropsychological testing has been adopted to evaluate and manage concussions, as demonstrated in the previous research studies.

#### *Athletic Trainers*

Finally, the inaccurate incidence rate among high school football players can be attributed to the lack of obtaining data from the professionals who identify, manage, and evaluate concussions. The frequency of concussion reported in several studies, when athletes and athletic trainers were asked to state the total number of concussions sustained in a season, revealed differences when compared to national data which relies on ER visits. Guskiewicz, Weaver, Padua, & Garrett (2000) constructed a questionnaire for athletic trainers to report concussions during the football season over a three year period. Their questionnaire included identification of the duration of symptoms, time before returning to play, and who made the decision of returning to play. Their data revealed that of the 17,549 football players, 888 (.05%) sustained one concussion and 131 (.01%) a second concussion. Seventy-one percent of the time, the team physician and athletic trainer made the return-to-play decision, whereas in the high school setting it was always the athletic trainer who made the RTP decision. McCrea (2004) also found that

76.7% of concussions are reported only to the athletic trainer. These studies identify the athletic trainer as the primary professional on the sideline who managed concussions not seen in the ER. The researchers also suggest that the incidence of concussion in high school football is not nearly as prevalent as previously reported. Guskiewicz, Bruce, Cantu, Ferrara, Kelly, McCrea, Putukian, McLeod (2004) reported that certified athletic trainers on average care for 7 concussive injuries per year.

Similarly, a descriptive survey that consisted of 32 questions was used to evaluate the clinical practice, habits, and decision-making skills of athletic trainers in sport related concussion (Notebaert & Guskiewicz 2005). Although there were various questions asked, the average number of concussions diagnosed per year was  $8.2 \pm 6.5$ ; only 20% of athletic trainers reported evaluating more than 10 concussions per year, with more than 50% of those being in the high school setting. Surveys reported the team physician was the primary person to make return to play decisions, followed by the athletic trainer. The information provided first-hand from AT's is crucial because according to the majority of studies, they are the individuals on the sideline assessing concussions. Furthermore, 78% of athletic trainers reported that every AT should be trained to administer neuropsychological tests to assess concussion and/or work with clinicians and team physicians on a collaborative approach to incorporate as many tools and methods as possible to obtain a complete picture of each athlete's concussion.

The professionals who manage and evaluate concussion are a vital component to early recognition of the signs and symptoms of concussion. Among certified athletic trainers there is a lack of agreement concerning the definition of and lack the critical symptoms relating to concussion (Notebaert & Guskiewicz 2005). Although this disagreement exists when evaluating

and managing a concussion, the use of any scale can guide any professional to the similar recovery path for the athlete.

External factors in reporting concussions also influence the incidence rate of concussions. Between the ages of 14-19 years an adolescent is significantly influenced by peers, media, coaches, and family when they consider reporting a concussion, because of the chance that they will be withheld from play (Patel et al, 2005). These outside influences seriously impact whether or not an athlete reports having sustained a concussion. Bailey, Echemendia, and Arnett (2006) have studied the influences of athletes' devotion to the sport and their future athletic career and how these factors affect reported and unreported concussion. The researchers explain how even short periods of time away from playing or practicing "can have significant negative consequences both individually (loss of position on team, loss of playing time which may impact external recognition and future athletic career, etc.), and for the team (loss of active players from the team, which may result in worse general team performance, etc.)" (p.476). It is vital to inform and teach the adolescent the risks and consequences of not reporting or managing a concussion so they are better able to recognize the risks of concussions, even preventing death.

Bailes and Cantu (2001) rank football as the number one growing activity, in both the number of participants and incidence of head injuries in the United States. Further research in sport-related concussion in high school football is warranted to provide professionals an accurate report of the incidence of concussion. This is not only to highlight the importance of recognizing education in concussions, evaluation, and management of concussions; but also to prevent the many potential risks an athlete encounters after having sustained a concussion.

### *Purpose of current study*

Although interest in concussion research is at a high, underreporting of concussion in football is of concern to research and the professionals who manage concussions. The need for evidence and regular, updated estimates (Sosin, et al., 1996) of concussion in high school football players will allow professionals to improve identification, treatment, prognosis, and general practice, in a population that is at high risk for serious consequences after sustaining a concussion. Research is driven by communication, via websites, journals, and research shared by professionals for progress in science. This communication also extends to those who are more likely to manage concussions and, as stated before, should not solely rely on hospital reports of emergency department visits. One attempt to address this issue is the current study. The purpose of this study is to investigate whether there is a difference between the frequencies of concussion reports by athletic trainers, versus emergency department visits of individuals with concussion in high school football players in El Paso, Texas. It is hypothesized that there is a statistically significant difference between the number of high school football athletes who do not receive medical treatment at ED and those athletes who are evaluated and managed for concussions by a high school athletic trainer.

## Chapter 2: Method

### *Participants*

Participants were informed about the current study at a monthly meeting of the Sun City Athletic Trainers Association (SCATA), where their contact information was collected (telephone and email address). Inclusion criterion was specified as the AT who is responsible for the football team where they are employed.

Eighteen athletic trainers employed at sixteen high schools in the Southwestern United States region served as the sample for this study. Every high school employed two (and occasionally three) athletic trainers. When trainers were asked if they were responsible for managing the football team, two stated they shared the responsibility with their co-athletic trainer. In responding the questionnaire, these two athletic trainers said the other managed a concussed athlete, therefore 16 athletic trainers reported the frequencies of concussion; 18 athletic trainers were used for qualitative data.

Each participant was given an informed consent form that had been approved by the university's institutional research review board (UTEP IRB# 125897-1). The form indicated; (1) the study concerned concussions in football, (2) participants had the option to not take part in the study, (3) if they did participate they could withdraw from the study at any time without penalty, and, (4) upon completion of the questionnaire a \$20 dollar gift card would be issued. All athletic trainers signed the form and participated fully.

In order to maintain confidentiality, the questionnaires were administered in the athletic trainers' personal offices. Although the principal investigator was present, participants were assured that the documents, questionnaire, and informed consent would be coded and separated

to not identify the respondents. As soon as the data was transcribed and recorded the documents were filed and locked in the UTEP Concussion Management Clinic.

One school district did not participate in the study, excluding 10 high schools from the total count. The final sample consisted of 18 athletic trainers from the 16 participating high schools. In the state of Texas an athletic trainer must obtain a state license to meet minimal requirement to practice. A national certification is optional, not required. Of these athletic trainers all (100%) were licensed and 8 (44.4%) were certified and licensed.

#### *Hospital Participants*

Five hospitals were contacted in the El Paso area and a printed report of emergency department visits was requested with the following specified criteria:

- Football injuries
- Sustained within time period of June-Dec of 2010
- Ages 14-19 years old
- Received an ICD- 9 code of 850-850.9 (at any level, primary, secondary, tertiary).

Four of the five hospitals provided the requested data; the hospital that did not participate is a military hospital. Each report was requested to be de-identified and to not include any private health identifiers. If the hospital required IRB approval, the necessary paperwork was submitted and reviewed by a board who provided an approved the submitted protocol.

#### *Institutional Review Board Approval*

A research protocol was submitted to 5 local school districts requesting approval to conduct the current study. If approval was provided by the school district 4 of the 5 approved and a letter from the superintendent on their school districts letterhead was provided, granting

permission to the PI to contact the high schools within their respective district. The investigator then took the letter from the superintendent to each corresponding high school within their district. It was required that the Principal provide permission to conduct research on their campus. If the Principal approved the study, a letter on their high school letterhead was provided indicating approval for the PI to schedule interviews with their athletic trainer.

The hospitals that requested IRB submission have approved this study. The trauma records or medical records department for each hospital were contacted for the requested reports.

All documents were uploaded to the Institutional Review Board (IRB) at the University of Texas at El Paso (UTEP) who approved this study (#125897-1).

### *Funding*

The PI submitted an application to the Graduate School at UTEP for funding for the current study. The graduate school approved the study and granted the PI with \$500.00 dollars of funding to conduct the research.

### *Procedure*

The 18 athletic trainers were contacted via telephone or email to schedule a face-face to interview. Once interviews were scheduled the PI drove to each high school to provide the questionnaire and assure all questions were responded to or to provide clarification on any of the 21 questions. The researcher gave each athletic trainer two documents: an informed-consent form and the questionnaire (Appendix A). Participants were asked to read and sign the informed consent form, and then complete the questionnaire. Every interview was audio recorded to ensure all responses were noted, if not written on the questionnaire and used for measures of reliability. The researcher coded and separated the informed consent forms from the questionnaires upon receipt and delivered a gift card of \$20.00 dollars to each participant for their participation.

### *Instrumentation*

A questionnaire (refer to Appendix A) was developed that consisted of 21 questions. The beginning of the questionnaire gathered background information, including years of experience,

level of education, and the name of their school district. The following questions asked the participant to define concussion, report the number of athletes that have sustained a concussion in the previous football season (Jun-Dec 2010) and from those how many visited a family physician and/or the emergency department. They were then asked to report the most common symptoms noted and reported, the scales used to assess an injury, and decisions made for benching, returning to play and evaluating an athlete after having sustained a concussive injury. Finally, the participants' opinion was asked in regards to educating athletes on concussions and possible motivational reasons as to why athletes withhold information.

#### *Content Validity and Face Validity of the Questionnaire*

Athletic trainers at the collegiate level, 3 universities (east coast, southwest, and west coast) reviewed the questionnaire. These certified athletic trainers suggested modifications and approved the questionnaire for its intended purposes.

#### *Analysis*

The primary investigator coded both questionnaire data and hospital reports in SPSS, Statistical Package for the Social Sciences. After all questionnaire information was entered into the dataset and all hospital reports entered as well, the primary investigator and two individuals cleaned the datasets to avoid data processing errors (Bryman, 2001). The researcher analyzed the data using SPSS Statistics Student Version 17.0 to calculate the frequency counts including percentages and some median scores for data that were scored using a nominal scale and the percentages for ratio/continuous data. Using alpha levels of 0.01 and 0.05, the Mann-Whitney test ( $U$ ) and T-test was used to compare two independent values. The Spearman's Rank and Pearson  $r$  Correlation was used to identify relationships between variables.

### Chapter 3: Results

#### *Questionnaire Data*

#### *Athletic Trainers demographic information*

All 18 (100%) from the 16 high schools that were contacted for the study responded to the questionnaire. Each athletic trainer was asked to provide their highest level of education, years of experience as an athletic trainer, and if they were licensed or certified (Table 6). Eighteen athletic trainers comprised the total sample size (16 of the 18 reported the frequencies of concussions per high school). Of the 18, 10 (56%) reported that their highest level of education was a Bachelor’s degree. Seven (39%) received a Master’s degree and 1 (6%) received a PhD degree. Regarding to certification and licensure, 10 (56%) only had their state license and 8 (44%) received their licensure and a certification. In the state of Texas an athletic trainer must obtain a state license to meet minimal requirement to practice. A national certification is optional, not required. Of these athletic trainers all (100%) were licensed and 8 (44.4%) were certified and licensed. They each were asked to report the years of experience as an athletic trainer. The range of years was from a minimum of 4 years to a maximum of 29 years ( $M = 15.42$  yrs.,  $SD = 8.055$ ).

<b>Table 6: Athletic trainers demographic information</b>		
	Frequency, N=18	Percentage
<b>Level of Education</b>		
Bachelors	10	56%
Masters	7	39%
PhD	1	6%
<b>Licensed or Certified</b>		
Licensed	18	100%
Licensed Only	10	56%
Certified	8	44%
<b>Range of Years of Experience as an athletic trainer, n=18</b>		
Minimum	Maximum	Mean, SD
4	29	$M=15.42, SD=8.055$

*Athletic trainer form of documentation/reporting data*

The researcher noted how each athletic trainer reported the specified information on the questionnaire, whether they reported by “memory recall”, “written documentation”, or “digitally archived” (Table 7). The forms of documentation were defined as the following: written documentation referred to any form of hardcopy filed paperwork with an injury written/typed on the form with a description of the concussion injury, digitally archived referred to a type of computer logged and saved documentation, and memory recall referred to the use of neither written or digitally archived documents, straight from the individuals memory. Fourteen (88%) athletic trainers reported concussion frequencies from memory recall. Two athletic trainers (13%) reported the information from written documentation, and not one trainer referred to digital archives.

<b>Table 7:</b> Athletic trainer reported the frequencies of concussions based on memory recall or written documentation.		
<b>Form:</b>	<b>Frequency</b>	<b>Percentage</b>
Memory Recall	14	88%
Written documentation	2	13%

*Total number of athletes and concussed athletes per football team*

Athletic trainers were asked to report how many athletes participated on their football teams (Table 8). There were a total of 2,263 football players. The athletic trainers reported 720 varsity players, 646 JV players, and 867 freshman players. Of the total varsity football players 57 (7.9%) were reported to have sustained a concussion. Twenty (3.0%) JV players and 28 (3.2%) freshman players were reported to have sustained a concussion. From the total of 2,263 football players, 105 (4.6%) athletes were reported to have sustained a concussion in the 2010 football season.

**Table 8:** Concussions within the different levels of play and total percentages (varsity, JV, freshman), N=16, M=6.56

Classification	Varsity	JV	Freshman	Total
Total # of athletes	720	646	867	2263
Concussed players	57	20	28	105
Percentage Concussed	7.9%	3.0%	3.2%	4.6%

*Occurrence of concussions during games or practice*

The athletic trainers were asked to identify how many of the total of concussions they managed occurred during a game or during practice (Table 9). Forty-three (41%) concussions occurred during practice, and 62 (59%) concussions occurred during a game.

**Table 9:** Number of concussions that occurred in a game or practice.

N=105	Frequency	Percentage
Game	62	59%
Practice	43	41%

*Artificial vs. Natural Turf*

After reporting the total number of concussions, the athletic trainer was asked to identify the type of turf the concussions occurred on, artificial or natural. The athletic trainers reported 25 (24%) concussions occurring on artificial turf and 80 (76%) concussions occurring on natural turf (Table 10).

**Table 10:** Type of turf concussions occurred on.

	Frequency	Percentage
Artificial Turf	25	24%
Natural Turf	80	76%
Total # of concussions	105	

*Number of athletes referred to a physician and ED, per athletic trainer*

From the total number of concussions reported by the athletic trainer, they were further asked to identify how many were referred to a physician and how many went to the emergency department (Table 11). Seventy (67%) athletes were referred to a physician and 23 (22%) went to an ED. Of the total number of concussions that occurred in the football season of 2010, eight athletic trainers sent every athlete that sustained a concussion to a physician. Of the total number of concussions, 25 (24%) athletes that sustained a concussion did not receive any type of medical attention. Furthermore, the ATs were asked to identify the number of athletes suspected of withholding information about suffering a concussion and a total of 105 athletes were reported. Due to the nature of the question and the lack of specificity this question could have provided a frequency number of athletes identified as withholding information on sustaining a concussion or if they withheld information about the concussion they sustained. The number reported by the athletic trainers was not included in any further analysis for the current research.

<b>Table 11:</b> Total number of referrals to a physician, total referred to the emergency department by athletic trainers after an athlete sustained a concussion; and total number of athletes that did not receive any sort of medical attention.		
Total # of concussions, 105	Frequency	Percentage
# Referred to a physician	70	67%
# Referred to the emergency department	23	22%
# Of athletes that did not receive any medical attention	25	24%

*\*The athletic trainers identified a total of 105 athletes being suspected of withholding information about a concussion.*

*Athletic trainer's definition of a concussion*

In order to identify if the athletic trainers adhere or rely on a common definition of concussion an open-ended question asked athletic trainers to provide their definition of a concussion. All responses were transcribed into an Excel document and analyzed by word

frequency (refer to Appendix B for transcriptions). The terms used by all 18 (100%) athletic trainers were “brain” and/or “head” in their definitions (Table 12). The term “brain” used solely in the definition was used by eight (44%) athletic trainers, and the solely the term “head” by seven (38%). Those that used both terms in their definitions were three (16%). The term “symptoms” was used by four (22%) and “altered mental/physical status” was used by five (27%) athletic trainers. The terms used to describe the type of impact to the head/brain varied (Table 13), but the most common term used was “injury” which was used by seven (38%) of athletic trainers. The term “trauma” was identified by four (22%) the athletic trainers. Three (16%) athletic trainers used the term “blow” to the head/brain. The term “bruise” was identified two times (11%) by the athletic trainers. Lastly, the following terms all were used by one (5%) of the participants, “blunt force”, “contusion”, “sudden jolt”, “pressure/compression”, and “shake”.

**Table 12:** Frequencies of terms the athletic trainers used to define a concussion.

<b>Term</b>	<b>Frequency</b>	<b>Percentage</b>
Brain or head	18	100%
Brain only	8	44%
Head only	7	38%
Both brain and head (in def.)	3	16%
Symptoms	4	22%
Altered mental/physical status	5	27%

**Table 13:** Frequencies of terms used to describe the type of impact to head/brain in definitions of concussions used by the athletic trainers.

<b>Term</b>	<b>Frequency</b>	<b>Percentage</b>
Blunt force	1	5%
Injury	7	38%
Contusion	1	5%
Sudden Jolt	1	5%
Pressure or compression	1	5%
Shake	1	5%
Blow	3	16%
Bruise	2	11%
Trauma	4	22%

*Scales use by athletic trainers to assess a concussion*

Athletic trainers were also asked to identify the scale(s) they used to identify and assess a concussion (Table 14). They were provided with six choices and an ‘other’ choice, and were allowed to check all that apply. The scale used most frequently, nine (50%), was the ImPACT scale, followed by the SAC scale, which was used by four (22%) of the athletic trainers, and three (17%) used the GCS. The following four scales, SCAT, BESS, UIL, and personal experience, each were used by two (11%) of the athletic trainers. One (6%) athletic trainer used the CDC scale, zero participants reported using the AAN scale, and one athletic trainer reported using no scales.

<b>Table 14:</b> Different scales used by the athletic trainers (athletic trainers were allowed to choose more than one)								
Total # of Scales used by the AT	SCAT 11%	Impact 50%	SAC 22%	GCS 17%	CDC 6%	BESS 11%	UIL 11%	Personal Experience 11%
2		X	X					
4		X	X	X		X		
0								
1		X						
1		X						
1		X						
2				X	X			
2	X	X						
1	X							
1		X						
1			X					
1								X
1							X	
2				X			X	
1		X						
1								X
1		X						
1			X			X		

*Symptoms most noted by the athletic trainer*

The athletic trainers were then asked to identify the symptoms most noted when assessing and managing a concussion (Table 15); they were allowed to check all that applied. All 18 (100%) of the athletic trainers identified “headache” as a symptom noted after an athlete sustains a concussion. Sixteen (89%) of the athletic trainers identified “dizziness”, “difficulty concentrating” and “balance problems”. Fifteen (83%) athletic trainers identified “sensitivity to light” as a symptom after sustaining a concussion. “Sleepiness”, “visual problems”, “mental foggy”, “nausea”, and “drowsiness” symptoms were reported by 12 (67%) athletic trainers. Nine (50%) reported, “vomiting”, and eight (44%) reported “slowed down”, “sensitivity to noise”, and “fatigue”. Seven (39%) athletic trainers identified “emotional”, and four (22%) identified “irritability”. Finally, three (17%) of the athletic trainers identified “sadness” and “other” symptoms and two (11%) identified “nervousness”.

In comparison (Figure 2), the athletic trainers were asked to identify the most frequently reported symptoms by the athlete after sustaining a concussion (self-report). All eighteen (100%) of the athletic trainers reported “headache”, “nervousness”, “sadness”, and “other” as the symptoms most commonly self-reported by the athletes after sustaining a concussion. Thirteen (72%) identified “dizziness” and “difficulty concentrating”, and 12 (67%) “sensitivity to light”. “Nausea” was reported by 11 (61%) of the athletic trainers. Eight (44%) of the athletic trainers identified “mental foggy” as a symptom reported by athletes. The symptoms identified by seven (39%) athletic trainers were; “slowed down”, “visual problems”, “balance problems”, “sensitivity to noise”, and “drowsiness”. Six (33%) said athletes report “fatigue” and five (29%) identified “sleepiness”. Additionally, four (22%) athletic trainers said athletes report “emotional” and “vomiting” and only one athletic trainer identified “irritability” as being reported by athletes after sustaining a concussion.

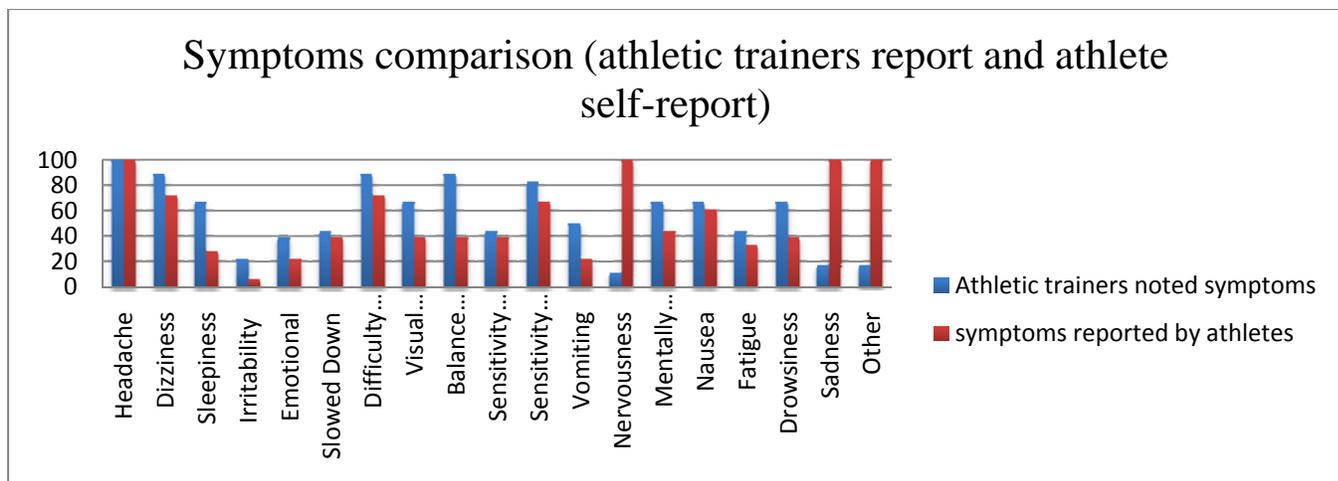


Fig. 2 Comparison of the symptoms noted most often by athletic trainers (blue) and the symptoms that athletes self-report to the athletic trainer most frequently

**Table 15:** Frequencies and percentages of the symptoms athletic trainers most often note and the symptoms athletes most frequently report to athletic trainers.

Symptom	ATC-Frequency	ATC-Percentage	Athlete-Frequency	Athlete-Percentage
Headache	18	100%	18	100%
Dizziness	16	89%	13	72%
Sleepiness	12	67%	5	28%
Irritability	4	22%	1	6%
Emotional	7	39%	4	22%
Slowed Down	8	44%	7	39%
Difficulty Concentrating	16	89%	13	72%
Visual Problems	12	67%	7	39%
Balance problems	16	89%	7	39%
Sensitivity to noise	8	44%	7	39%
Sensitivity to light	15	83%	12	67%
Vomiting	9	50%	4	22%
Nervousness	2	11%	18	100%
Mentally Foggy	12	67%	8	44%
Nausea	12	67%	11	61%
Fatigue	8	44%	6	33%
Drowsiness	12	67%	7	39%
Sadness	3	17%	18	100%
Other	3	17%	18	100%

### *Benching decisions during a game and during a season*

The athletic trainers were asked if an athlete is benched for the remainder of the game after sustaining a concussion (Table 16); and all 18 (100%) reported yes. They were then asked

after how many concussions would an athlete be benched for the rest of the season; 11 (61%) reported after three concussions. Three (17%) athletic trainers reported after two concussions and one (6%) reported never benching an athlete. Three (17%) of the athletic trainers reported that depending on the severity of the concussion they make a decision on benching the athlete for the season. After the interviews were transcribed, the researcher identified 16 (89%) athletic trainers who verbalized that their decision would depend on the severity of the concussion, but for purposes of the questionnaire they provided a raw number also.

<b>Table 16:</b> The number of concussions it takes for an athletic trainer to bench an athlete for the remainder of a football season.		
	<b>Frequency</b>	<b>Percentage</b>
<b>Benched for the rest of the game</b>		
Yes, athlete is benched for the remainder of the game after sustaining a concussion	18	100%
<b>Number of concussions it takes to bench for the rest of the season</b>		
Never bench an athlete for the season	1	6%
2 concussions	3	17%
3 concussions	11	61%
Decision based on the severity (DOS) of the concussion	3	17%
Transcription, verbalized DOS:	16	88.9%

*Athletic trainers follow up procedures & Return to Play (RTP) decisions*

The athletic trainers were provided with an open-ended question, in which they were asked to provide how they manage and follow-up on a concussed athlete (Table 17). The researcher identified the different protocols followed by the athletic trainers and identified the frequency of each (refer to Appendix C for transcription of responses). Thirteen (72%) of the athletic trainers reported having “daily checks/visits” with the concussed athlete. “Parent contact” and “communication with the athlete” were each reported by three (16%) athletic trainers. Of the 18 athletic trainers, at least two (11%) athletic trainers identified the following in

their management and follow-up protocol, “exertion exams”, “ImPACT testing”, “return to practice with limitations”, “communication with the coach”, “physician clearance”, and “following the athlete even after returning to play”. One athletic trainer (5%) reported a “SAC re-eval”, one also reported “48 hour re-assess”, one (5%) also identified athlete must be “asymptomatic” and another athletic trainer reported (1, 5%) that if the athlete does not appear to be ready to return to play they disregard the doctor’s clearance until the trainer releases the player.

**Table 17: Athletic trainer’s management and follow-up procedures for a concussed athlete.**

<b>Protocols</b>	<b>Frequency</b>	<b>Percentage</b>
Daily Checks/visits	13	72%
Exertion Exams	2	11%
Parent contact	3	16%
ImPACT evaluation	2	11%
SAC re-eval	1	5%
Return to practice w/limitations	2	11%
Communication with Athlete	3	16%
Communication with Coach	2	11%
48 hour re-assess	1	5%
Physician clearance	2	11%
Doesn’t release regardless of Dr. clearance	1	5%
Follows Athlete even after RTP	2	11%
Asymptomatic	1	5%

Additionally, the athletic trainers were asked questions regarding return-to-play (RTP); (1) who makes the decision for an athlete to return to play and (2) which factors are considered to allow an athlete to return to play. One (6%) athletic trainer reported four individuals in deciding RTP and eight (44%) reported three individuals. Seven (39%) athletic trainers identified two individuals and two (11%) ATs identified one individual responsible in deciding RTP for a concussed athlete. Of the 18 athletic trainers, 17 (94%) said they (the athletic trainer) are one of the individuals who made the decision for the athlete to return to play, followed by 15 (83%) reporting a physician (family/personal) as an individual who makes the decision. Five (28%)

athletic trainers reported the team physician as one of the persons who makes the decision about returning to play. Three (17%) reported a neurologist makes the decision, and two (11%) reported the concussion management clinic at UTEP makes the decision to RTP. One athletic trainer (6%) reported that the parent(s) makes the decision to RTP. There were no reports of the coaches, the player, and/or “other” individuals who make the decision of returning to play for the concussed athlete. The researcher collapsed the categories of ‘team physician’, ‘neurologist’, ‘family physician’, into a general ‘physician’ category, and data revealed that 17 (94%) of the athletic trainers reported a team effort in deciding RTP for an athlete; team consisted of the AT and a physician.

**Table 18:** Frequency of what individual is responsible for deciding RTP, N=18

# Of individuals who made the decision for RTP	Athletic trainer 94%	Team Physician 28%	Neurologist 17%	CMC UTEP 11%	Physician 83%	Parent 6%
3	X			X	X	
3	X			X	X	
3	X	X			X	
3	X	X			X	
1					X	
1	X					
4	X	X	X		X	
3	X	X	X			
3	X		X		X	
2	X				X	
2	X				X	
2	X				X	
2	X				X	
3	X	X			X	
2	X				X	
2	X				X	
3	X				X	X
2	X	X				

*\*Team decision, AT and a physician, 94%.*

Athletic trainers were asked to identify the factors they consider before returning an athlete to play (Table 19). All 18 (100%) of the athletic trainers reported that an athlete had to be asymptomatic before a decision was made to return an athlete to play/practice. Fourteen athletic trainers (78%) identified passing stress exertion tests as a factor for RTP, followed by 13 (72%) ATs, which required an athlete to pass a balance tests before deciding whether an athlete was ready to RTP/practice. Doctor clearance was identified by 6 (33%) of the athletic trainers as a necessary step. Two (11%) athletic trainers identified the athlete having to return to baseline scores for RTP and two also reported that an athlete must be asymptomatic for seven consecutive days to RTP. Lastly, one athletic trainer (6%) reported having the athlete passing a cranial nerve test, one athletic trainer reported a five-day RTP plan, and one reported a SAC re-evaluation to decide whether an athlete could RTP/practice.

**Table 19:** Different factors athletic trainers used to decide if an athlete was ready to play/practice after sustaining a concussion, N=18

<b>Factor</b>	<b>Frequency</b>	<b>Percentage</b>
Asymptomatic	18	100%
Returned to baseline scores	2	11%
Passed balance tests	13	72%
Passed stress exertion tests	14	78%
Doctor clearance	6	33%
7 day asymptomatic	2	11%
5 day plan for RTP	1	6%
Passed a cranial nerve evaluation	1	6%
SAC re-evaluation	1	6%

*Additional information from questionnaire responses*

*Importance on educating athletes*

All the athletic trainers 17 (94%) were asked and responded “yes” to the question, “Is it important to educate athletes about concussions?” If they responded yes, they were asked to

explain why it is important to educate athletes. Due to the nature of an open-ended question in explaining why it is important to educate athletes about concussions, responses were variable. The researcher categorized responses by identifying a commonality among the terms used. Five (28%) athletic trainers reported that athletes should be provided with information regarding concussions to recognize the signs and symptoms of a concussion in order to report having sustained one, as well as five (28%) stating that athletes need to understand the consequences of a concussion. Four (22%) stated the importance in educating the athlete, the parents, the coaches, and/or the medical community to recognize and understand what a concussion entails. Three (17%) stated the importance of educating athletes so they recognize a concussion, but not just for themselves, for their teammates as well. The last commonality in explaining why athletic trainers think it is important to educate athletes were reasons such as: the athlete will be less likely to report a concussion if they don't understand what it is, athletes need to know what second-impact syndrome is, an athlete may be more open in responding to questions after sustaining a concussion, and athletes need to know the different risks and dangers of unreported concussion (Appendix D for transcriptions of responses).

### *Motivational factors and their influence*

The athletic trainers were also asked for their opinion in regards to athletes NOT reporting a concussion due to motivational factors (Table 20). Seventeen (94%) reported that “yes” athletes do not report concussions due to motivational factors, they were then asked to identify which factors may influence the lack of reporting a concussion. All 18 (100%) identified “being tough” as a factor for an athlete not reporting a concussion. Sixteen (89%) athletic trainers identified that athletes do not report concussions because they are a “starting player”. “Coach influence” and “senior year” each was a motivational factor identified by 13

(67%) athletic trainers. Twelve (67%) identified “family influence” as a motivational factor in not reporting concussions. “Peer influence” was identified by 11(61%) athletic trainers, six (33%) identified “other” factors, and only two (11%) identified “scholarship opportunities” as motivational factors influencing concussion reporting.

**Table 20:** Motivational factors reported to influence an athlete to report a concussion.

	<b>Frequency</b>	<b>Percentage</b>
Checked yes, ‘athletes do not report concussions because of motivational factors’	17	94%
<b>Factors:</b>		
Scholarship Opportunities	2	11%
Starting Player	16	89%
Being tough	18	100%
Coach influence	13	72%
Family influence	12	67%
Peer influence	11	61%
Senior year	13	72%
Other	6	33%

*Athletic trainer’s continuing education*

The questionnaire included a question regarding the type of continuing education that athletic trainers participated in within the past three years. For data analysis the researcher compiled the categories, courses, presentations, conventions, and professional organizations for frequency counts and percentages, due to the variability in responses. The categories online and journals were analyzed individually. All of the athletic trainers 18 (100%) reported going to one or more of the following: conventions, presentations, or taking courses through National Athletic Trainers Association (NATA) and Sun City Athletic Trainer Association (SCATA). All 18 (100%) also reported having attended a presentation by Dr. Salvatore and his team from the UTEP Concussion Management Clinic. Two (11%) athletic trainers reported continuing information with NMATA, New Mexico Athletic Trainer Association. One athletic trainer (6%) reported continuing education with TAPHERD, the Texas Association for Health, Physical

Education, Recreation and Dance. Three athletic trainers each identified attending out of town conventions. In regards to online continuing education, approximately nine (50%) of the athletic trainers reported having used one or more of the following; Google, UIL website, NATA website, CDC website, search engines, and the National Federation of High School Sports online. The journals used by the athletic trainers for continuing education ranged from the Journal of Athletic Trainer four (22%), NATA Journal 6 (33%), Sports Health one (6%), Training and Conditioning one (6%), UIL four (22%), and news journals. In general, the most commonly used source, by athletic trainers is the utilization of the NATA. Regional (southwest) conventions were also attended (South Padre Island, Ft. Davis, San Antonio, Davis Mt., and Arlington) and were common amongst the athletic trainers. Lastly, at the local level, the SCATA organization and presentations provided by the UTEP Concussion Management Clinic appeared to be most commonly attended by the athletic trainers.

#### *Hospital emergency department reports*

Each hospital provided a print out of the emergency department visits that received a concussion diagnosis code of 850-850.9 (Table 21) within the same time period provided to athletic trainers (Jul-Dec 2010). The total number of injuries identified with a concussion code was 47. Of the 47 concussion injuries each received a specific ICD-9 code describing the concussive event. The most frequently assigned code by hospitals was 850.0 with a frequency of 23 (49%), followed by the code 850.5 with a frequency of 14 (30%). The code 850.11 was assigned five times (10%), and 850.9 4 times (9%). The code 850.1 was diagnosed only one time (2%).

<b>Table 21 : Hospital frequencies and percentages of diagnostic codes assigned at the emergency department</b>		
<b>Diagnostic CODE</b>	<b>Frequency</b>	<b>Percentage</b>
850.0 Concussion with no loss of consciousness	23	49%
850.5 Concussion with loss of consciousness of unspecified duration	14	30%
850.11 Concussion with loss of consciousness of 30 minutes or less	5	10%
850.9 Concussion unspecified A violent jar or shock, or the condition, which results from such an injury.	4	9%
850.1 Concussion with brief loss of consciousness	1	2%

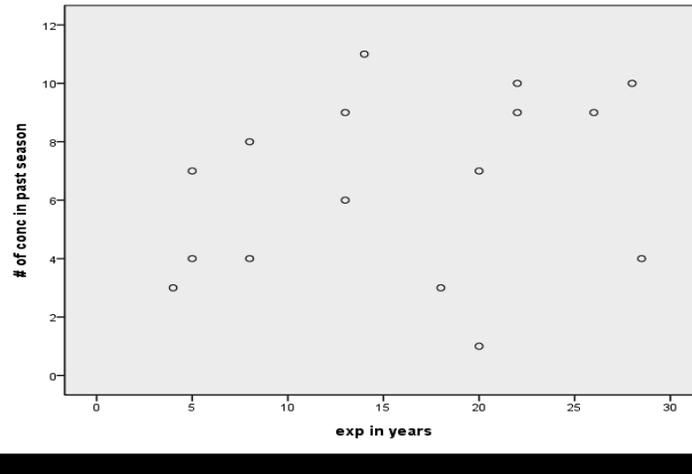
Furthermore, each hospital was requested to identify if the concussion diagnosis was the primary, secondary, or tertiary code assigned. Fourteen (74%) of the injuries reported received concussion as the principle diagnosis. Four (21%) received the diagnosis as the secondary injury and one (5%) received a concussion code as the third injury.

<b>Table 22: Concussion diagnosis code as per hospital reports</b>		
<b>Diagnosis Code</b>	<b>Frequency</b>	<b>Percentage</b>
Principle diagnosis	42	93%
850	22	47%
850.5	14	30%
850.11	4	9%
850.9	4	9%
Secondary	2	4%
850	1	2%
850.11	1	2%
Tertiary	1	2%
850.1	1	2%

*Difference between ATC concussion reports and hospital concussion reports*

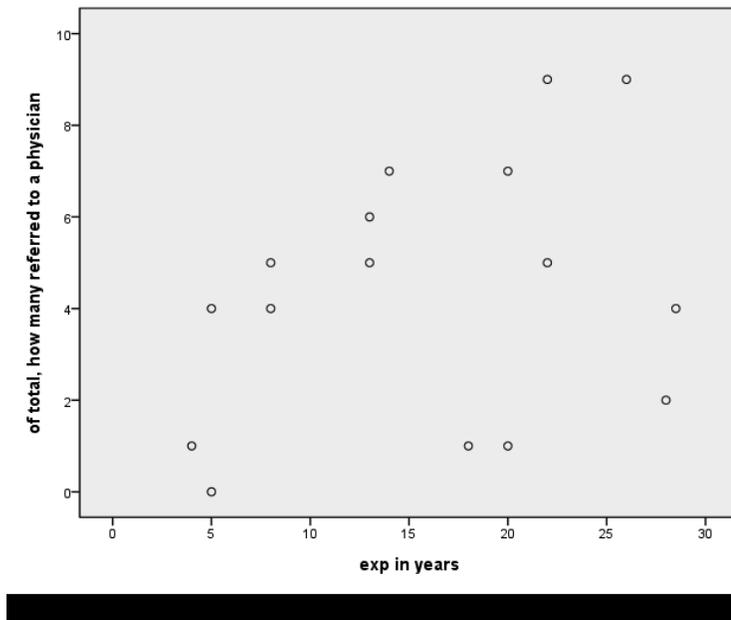
Each athletic trainer was asked to report the number of concussions they managed throughout the football season within Jul-Dec 2010. In total athletic trainers reported 105 concussions. The hospital reports gathered, which included the number of concussions within the same time period but given the diagnostic code for concussion, totaled 47. The mean number of concussions reported by 16 athletic trainers ( $M=4.34$ ,  $SD = 3.646$ ) was more than the mean number of concussions reported by hospitals ( $M = 1.54$ ,  $SD = .505$ ). A Mann-Whitney U test showed this difference to be significant:  $U = 43.50$ ;  $p < .01$  (two-tailed). An independent-samples t-test was conducted to compare and confirm the number of concussions reported by athletic trainers and hospitals. The t-test showed a significant difference from athletic trainers ( $M= 6.6$ ,  $SD= 3.05$ ) and from the hospital ( $M= 2.3$ ,  $SD= 3.04$ );  $t(33) = 3.95$ ,  $p = .000$ . Both parametric and non-parametric statistical analyses support the statistical findings without exception. Overall, there are a significant number of athletes who do not visit the ED after sustaining a concussion.

A Pearson correlation and Spearman's Rho was carried out on years of experience of the athletic trainers and the total number of concussions reported by athletic trainers. Although there was not a statistical significance, a small positive correlation between the two variables was found, (Pearson)  $r = .266$ ,  $n = 16$ ,  $p = .319$  – (Spearman's)  $r = .352$ ,  $n = 16$ ,  $p = .181$ . A scatterplot summarizes the results (Figure 3).



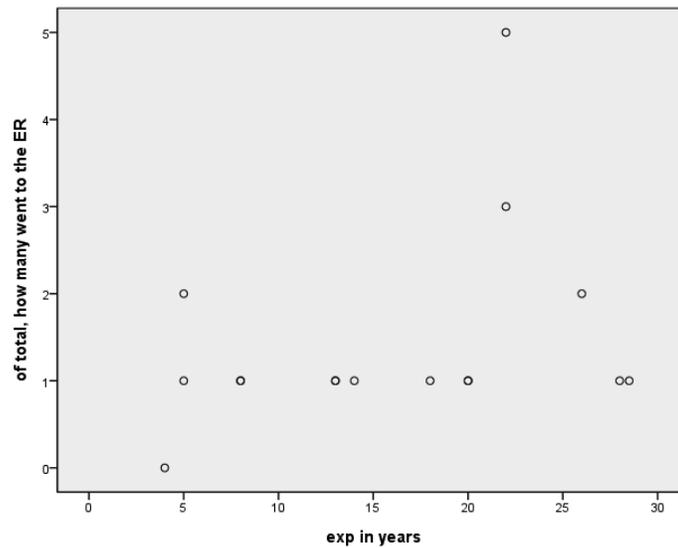
**Figure 3** Scatterplot displaying a small positive correlation between the years of experience of an athletic trainer and the total number of concussions they reported.

A Pearson correlation and Spearman’s Rho was also carried out on years of experience of the athletic trainers and the total number of concussions they referred to a physician. Although there was not a statistical significance found, there was a moderate positive correlation between the two variables, (Pearson)  $r = .321$ ,  $n = 16$ ,  $p = .225$  – (Spearman’s)  $r = .350$ ,  $n = 16$ ,  $p = .183$ . A scatterplot summarizes the results (Figure 4).



**Figure 4** Scatterplot displaying the relationship between years of experience of an athletic trainer and the number of concussions they refer to a physician.

A Pearson correlation and Spearman's Rho was also carried out on years of experience of the athletic trainers and the total number of concussions the AT referred to the ER. Although there was not a statistical significance between the two variables, there was a moderate positive correlation between the two variables, (Pearson)  $r = .330$ ,  $n = 16$ ,  $p = .211$  – (Spearman's)  $r = .394$ ,  $n = 16$ ,  $p = .131$ . A scatterplot summarizes the results (Figure 5).



**Figure 5** Scatterplot displaying the relationship between the years of experience of the AT's and the number of concussions they refer to the ER.

## Chapter 4: Discussion

The results of the current study revealed a statistically significant difference between concussions reported by athletic trainers than the number of concussions reported by hospitals. Current published estimates of the incidence of concussions in the United States have been limited to athletes who were hospitalized (Sosin et al., 1996; CDC, 2010; Bakhos, et al., 2010). The exclusion of athletes who do not visit the ER underestimates the incidence rate of concussions. Based upon the comparison of concussions reported by AT vs. admissions to the ER for athletes, it appears as though 55% of the cases of concussions reported by athletic trainers were not seen in the ER. Furthermore, this study identified 24% of concussion injuries did not receive any medical attention. A majority of the athletes were managed and evaluated by the athletic trainer and a physician. Evaluation of a concussion consists of immediate sideline attention relying on athletic trainers to diagnose a concussion and more often than not, these cases are not seen in the ER. The 24% of athletes that did not receive any medical attention and the 55% who were not hospitalized are an example of the concussed athletes not accounted for in the national datasets.

### *Incidence rate of concussions*

The factors that contribute to the discrepancy of incident rates of concussions among high school football players were addressed in the questionnaire used in this study. The questionnaire provided a look into how the (1) athletic trainers identified a concussion, (2) defined a concussion, (3) how many they refer for medical assistance, and (4) how they managed a concussion. Athletic trainers manage athletes who sustain a concussion, whether or not they visit the ED or a physician, therefore the frequencies of concussions reported by the AT are needed to provide a more accurate rate of concussions. Published studies and online reports (i.e. CDC)

agree that the incidence of concussions for high school athletes who participate in football is under-estimated (McCrea, 2004). The literature estimates an incidence rate of 3.6% -5.6% of concussions at the high school level (Powell & Foss, 1999; Delee & Williams, 1992; McCrea, 2004; Guskiewicz et al., 2000). In the current study, of the 2,263 football players under the supervision of the athletic trainers in this study, 105 were concussed, indicating a 4.6% occurrence of concussion among high school football players. Guskiewicz et al. (2004) reported that in their study, athletic trainers cared for an average of 7 concussive injuries. In the current study AT's cared for an average of 6.56 concussed athlete's. According to the hospital reports retrieved, there were a total of 47 concussions admitted to the ER. Based upon the total number of football players (2,263), hospital ED admissions accounted for 2% occurrence of concussions among high school football players. It is evident that the hospital admissions underestimate an accurate incident rate of concussion.

#### *Method of reporting*

In order to produce a more reliable source of data athletic trainers should use a standardized form of documentation. Meehan and colleagues (2010) utilized an online surveillance system, which permitted ATs to enter data regarding the injuries they managed in attempts to more accurately track athletic injury rates. Digitally archived or written documentation are reliable sources of data that do not depend upon the memory recall of a trainer. In the current study 88% of the ATs responded to the questionnaire by memory recall and did not refer to any written or digitally archived documentation. Often the frequency of concussions was discussed with a coach or another athletic trainer that was present during the interview. However, if athletic trainers are not documenting or simply not referring to their

documentation and are reporting by memory recall, this raises another confounding issue in accurately reporting the rate of concussions.

#### *Definition of concussion*

The absence of a more accurate incidence of concussions is often attributed to the lack of a standard definition of concussion. After the different definitions provided by the athletic trainers were analyzed, the variability of responses provided by the trainers supports the need for a common agreement on the definition of concussion. The ATs were asked to provide their definitions of a concussion in an open-ended question, and the one commonality identified was the use of the term “head” and/or “brain”, which was used by all (100%) the athletic trainers. They also used terms that described the type of impact to the head or brain; 38% used the term “injury” and 22% used the term “trauma”. The terms, blow, bruise, blunt force, contusion, sudden jolt, pressure/compression, and shake, were used with very low frequencies. This finding is in agreement with Notebaert and Guskiewicz (2005) who noted that among athletic trainers there was no agreement on a common definition of concussion.

#### *Concussion Assessment Scales*

Along with difficulty in identifying a common definition of concussion, ATs reported they used different assessment scales to evaluate a concussion. The questionnaire in this study provided eight different concussion assessment scales (Table 15) and an “other” option for the athletic trainers to identify the scale(s) they utilize when assessing concussions. Fifty percent of the athletic trainers identified the ImPACT on-field Cognitive Testing card to assess concussions, followed by 22% who reported using the SAC scale. In other studies Notebaert & Guskiewicz (2005) and Oliaro, et al. (2001), reported that 63% of the athletic trainers did not use any scale. In the current study three AT’s (16%) did not identify using any scale. The scales

reportedly used by AT's were variable and may indicate personal preference, or, unfamiliarity, exposure, and access to the different scales in assessing concussions. These results demonstrate the lack of agreement on a common concussion assessment scale.

#### *Symptoms identified after a concussive event*

The questionnaire addressed two aspects of symptom reports, (1) symptoms assessed by athletic trainers and (2) the most frequent symptoms reported by an athlete to the athletic trainer. Hall et al. (2005) identified headaches, dizziness, blurred vision, sensitivity to light and noise as the most common symptoms that arise after sustaining a concussion. All (100%) of the athletic trainers in the current study identified "headaches" as a symptom they note most frequently. Every symptom listed in the questionnaire was identified by at least two athletic trainers. Sixty-five percent of the following symptoms were identified by the ATs; dizziness, sleepiness, difficulty concentrating, visual problems, balance problems, sensitivity to light, mental foggy, nausea, and drowsiness, consistent with previous research.

AT's (100%) identified 'sadness', 'nervousness', and 'other' as self-reported symptoms by athletes. Yet, the AT's did not identify the same symptoms as symptoms they most frequently note. If the athletic trainers are aware of the symptoms athletes are reporting, why do they not directly address/ask those same symptoms. It may be inferred that "nervousness" and "sadness" in self-reports by athletes reflect their fear of being withheld from play or already being withheld from playing a game or the season.

#### *RTP Decisions & Factors*

The athletic trainers demonstrated conservative behaviors in deciding when to allow an athlete to return to play. The questionnaire asked each athletic trainer if after an athlete sustains a concussion, was the athlete allowed to return to the current game, all 16 (100%) athletic

trainers said no. Although AT's are essentially liberated of fault if they follow UIL guidelines (RTP allowed if asymptomatic after 15 minutes), not one stated they allowed the athlete to return to the game in which they sustained a concussion. The AT's protocols identified by the athletic trainers in follow-up and management of a concussed athlete all consisted of daily visits and communication with the athlete until the athlete was asymptomatic. Clearly, athletic trainers recognize the importance of withholding a player from immediately returning to play.

Athletic trainers were asked to identify (1) the factors they consider to allow an athlete to RTP, (2) the individual(s) who make the decision for an athlete to play, and (3) what their management and follow-up protocol entailed. McCrea (2004) and Guskiewicz et al. (2000) both identified in their studies that the athletic trainers were called upon the most frequently, in addition to the team physician. The current study supports that 94% of athletic trainers and a physician were the individuals who made the decision for RTP. This study suggests that a family physician, and not a team physician or a neurologist, is the individual who makes RTP decisions. All 18 (100%) athletic trainers identified that an athlete must be 'asymptomatic' to RTP, and with most identifying protocol measures such as passing balance or stress exertion test. It is interesting that the only 33% of the athletic trainers identified "doctor clearance" as a factor for returning to play, when previously 83% reported the physician who made the decision to RTP. It may be assumed that athletic trainers are taking precautions if and when an athlete may not be asymptomatic. Field et al (2003) identified the duration of recovery after a concussion in high school athletes to be about 7 days. AT's demonstrate recognition of individualized recovery rates in high school football players and although a doctor clearance is provided the trainers make the final decision in RTP.

Although current research suggests the use of neuropsychological tests in monitoring progress and recovery of a concussion with football athletes (Lovell et al., 2003 & Field et al., 2003) the athletic trainers in the current study reported different and various management and follow-up protocols which only 11% reporting the use of ImPACT, a neurocognitive test. Daily checks/visits with the concussed athlete were identified by 72% of the athletic trainers followed by various protocols at very low frequencies that included parent and athlete contact/communication, physician clearance, and balance or stress exertion exams. Ultimately, the athletic trainers are the individuals who decide RTP for a concussed athlete. A team decision was reached by the AT and a physician, but the majority of athletic trainers stated that even with doctor clearance they follow-up with their athletes ensuring symptoms have resolved and deciding RTP.

#### *Educating athletes*

The ATs also identified the importance of not only educating the athletes but also included educating coaches, parents, peers, and the community about the importance of recognizing what a concussion consists of and the potential risks following a concussion. This recognition is further highlighted by the ‘motivational factors’ identified by the AT’s that have influence on an athlete reporting a concussive event. The influences identified included the athlete, peers, family, and coach’s expectations. If these individuals are exposed to the impact of concussions on an athlete’s future one might hope that there would be a decrease in adverse consequences following a concussion.

#### *Motivational Factors*

Bailey et al. (2006) state, “most varsity athletes devote countless hours to the practice and participation of their sport and removal for even short periods of time can have significant

negative consequences” (p. 475) in reporting concussions and symptoms of a concussion. There are external factors that influence the decision of an athlete in reporting specifics after sustaining a concussion. Patel et al. (2005) addressed influences such as peers, media, coaches and family; and the results from this current study support all but one factor. At least 60% of the athletic trainers identified “being tough”, “starting player”, “coach’s influence”, “family influence”, “peer influence”, and “senior year” pressures as motivational factors that influence an athlete from reporting having sustained a concussion.

As suggested by McCrea (2004), this study supports the “need for educational initiatives” (p. 16) to inform young athletes, coaches, parents, peers, and professionals in the community of the importance of identifying and treating concussions appropriately. This is also evident in the responses provided by the athletic trainers when asked if they think it is important to educate athletes. The ATs were asked in an open-ended question why they think it is important to educate an athlete and in a majority of the responses Although the question was stated specific to ‘educate athletes’ most of the athletic trainers responses included educating coaches, parents, and professionals.

#### *Continuing education of ATs*

The questionnaire also addressed continuing education that the ATs have participated within the past three years. The continuing education the ATs reported having participated in was among local presentations and the national athletic trainers association (NATA). If sources such as the Concussion Management Clinic of UTEP did not reach out to the community through presentations, exposure to the importance of recognizing concussions relies solely on research sources like NATA publications and media stories. As a result of the dependence of research

sources identifying incident rates of concussions, a more accurate number of concussion rates will not be provided.

#### *Game vs. Practice & Turf concussions occurred on*

The current results revealed that concussions occur more frequently during a game vs. practice, and more on natural turf vs. artificial turf. The wording of these questions limits the conclusions that can be made. The number of games and practices were not identified, and the number of games played on natural and artificial turf was not identified as well. Although the majority of reported concussions occurred on natural turf, these preliminary results cannot conclude that natural turf is more susceptible to induce a concussive event. Due to the lack of artificial to natural turf total game ratio, this assumption may not be correct. It is recommended for future research to take a closer look at the exposure of these variables to provide conclusions of how level of competition and the kind of turf are related or contribute to concussion incidence.

#### *Withholding information*

Also, a question was provided that asked the athletic trainers if they suspected any of their athletes of withholding any information to the athletic trainer. Due to the nature of the question and the lack of specificity, the results were not included in the data analysis for the current research. Although, this question could have provided a frequency number of athletes identified as withholding information on sustaining a concussion or if they withhold information about the concussion they sustained (i.e. symptoms) could bring to light another aspect of unreported concussions in high school football players.

#### *Hospital Reports*

The second area of interest in the current study was the frequency of hospital emergency department visits. As stated previously, the hospital admissions identified a total of 47

concussions, indicating a 2% occurrence of concussion within the football season in June to December of 2010. The 2% occurrence would be the reported rate in research if the frequencies were only retrieved from the hospitals. Of the 47 concussions identified (23) 49% did not include any loss of consciousness. Previous research states that 90% of all concussions do not result in LOC (McCrea, 2001). The concussions that included some level of loss of consciousness were (20) 43%, which are the injuries that without a doubt are referred to an ED. Sosin et al. (1996) and Thurman et al. (1998) reported that 12% of 306,000 cases were hospitalized, 55% received outpatient care, and 34% received no medical care. The current study reflects a similar trend, as 55% of concussion cases did not receive hospital admission and 24% received no medical care based on AT report.

The reports provided included any football injury within the age range of high school football players. The number of ED visits may not truly reflect the total number of concussions among high school football players. ED visits may include not only concussions acquired during high school football games/practice but participation in recreational football, and street football. Therefore it can be assumed that ED visits of concussions sustained in high school football players is lower than provided in the current study.

The data of this current study suggests that 55% of concussions are not seen in an ED. When compared to athletic trainer reports of concussions identified in the same time period, 105 total concussions, the athletic trainers stated on the questionnaire that 67% of the concussions identified were referred to a physician, and 22% were referred to the ED. These results are compelling because 25 concussions were identified as not receiving any medical attention, not emergency department or physician attention.

Unfortunately the reports provided by the hospitals were limited to frequencies only with no descriptions or identifying information of the injuries seen in the ED, therefore the number of athletes referred to the ED by an athletic trainer may not be identified as having gone to the hospital. Although it is assumed that hospitals only admit severe cases of concussions, surprisingly the current study admitted more (49%) concussions with no loss of consciousness. Yet, the reports provided included any football injury within the age range of high school athletes, which may not truly reflect the number of concussions amongst high school football events that visit the ED. This is concluded because the ED visits may include recreational participation of football, street football, and outside participation of football within these ages. Therefore it can be assumed that ED visits of concussions sustained in high school football players is lower than provided in the current study.

#### *Strengths & Limitations*

The current study has several strengths. The use of a questionnaire in research tends to have a low response rate; in this study the researcher administered the questionnaire through face-to-face interactions. This allowed a 100% response rate and no missing data. The researcher's presence also allowed for consistent responses to all the questions, because each question (if requested or if difficulty was observed) was explained the same way with each athletic trainer. Also, in the city of El Paso, one hospital is identified as the specialized trauma hospital, which is assumed to receive all head injuries. The researcher included every hospital with an emergency department to account for every hospital in the city. The researcher assumed that any injury that occurs may be referred to the nearest hospital to where the injury occurred, rather than all cases being referred to just the specialized trauma hospital in the city.

Furthermore, the researcher interviewed the athletic trainer who was responsible for the football team. In previous studies of unreported concussion, such as McCrea's (2004), athletes responded to a questionnaire reporting the incidents they suspect may have been a concussion. This study is the first, specifically to high school football players only, that target the professional who evaluates and manages the football team at the high school level.

The study was also limited for a few reasons. First, 10 high schools and one hospital did not participate. This limited the study in representing the total populations. Second, the hospital's emergency department visits that received a concussion diagnosis were specified as "football injuries" but were not identified to have occurred during a high school football game or practice specifically. The injury could have been sustained while participating in recreational, street, or flag football events rather than sustained during an organized sport event in a high school. During the interviews, although they were held in the athletic trainer's personal office, often the athletic trainer was interrupted or distracted by a student or fellow employee, which may have affected their responses to the questionnaire. Lastly, the form by which the athletic trainers reported the frequency of concussion was done by memory recall. The reliability of these reports is threatened because there is no evidence to support the numbers reported by the athletic trainer.

## **Chapter 5: Conclusion**

The need for a more accurate rate of concussion incidence continues to grow. The current study shows that the present manner of reporting the incidence of concussion based upon ER visits greatly underestimates the incidence of concussion. The data shows a statistically significant difference between the number of concussions identified by athletic trainers than the number of individuals seen in ED of hospitals in El Paso. The findings also show that 55% of concussions identified by ATs were not admitted to a hospital, and 24% of concussions identified by ATs did not receive any medical attention.

It is important to identify and treat concussions among high school football players to prevent potential risks and cumulative effects that adolescents may experience after sustaining a concussion. In order to appreciate the extent of concussion injuries, there is a need for a reliable and standardized form of reporting the frequency of concussion cases. These results emphasize the need to create an agreed-upon guideline for (1) a concussion definition, (2) a concussion battery and management guidelines, and (3) a standard form of documenting concussion injuries in order to overcome the barriers that raise concerns about the true incident rates of football related concussions.

## References

- ACT for Youth Upstate center of Excellence Cornell University. (2002). Adolescent brain development.
- American Bar Association. (2004). Adolescence, brain development and legal culpability. *Juvenile Justice Center*.
- Aubry, M., Cantu, R., Dvorak, J., Graf-Baumann, T., Johnston, K., Kelly, J., Lovell, M., McCrory, P., Meeuwisse, W., & Schamasch P. (2002). Summary and agreement statement of the first international conference on concussion in sport, Vienna 2001. *The Physician and Sports Medicine*, 30(3).
- Bailes, J., & Cantu, R. (2001). Head injury in athletes. *Neurosurgery*, 48(1), 26-46.
- Bailey, C. M., Echemendia, R. J., & Arnett, P. A. (2006). The impact and motivation on neuropsychological performance in sports-related mild traumatic brain injury. *Journal of the International Neuropsychological Society*, 12(4), 475-484.
- Bakhos, L.L., Lockhart, G.R., Myers, R. & Linakis, J.G. (2010). Emergency department visits for concussion in young child athletes. *Pediatrics*, 126(3), 550-556.
- Bryman, A. (2001). *Social research methods*. New York: Oxford University Press, Inc.
- Cantu, R. (1996). Head injuries in sport. *British Journal of Sports Medicine*, 30, 289-296.
- Cernich, A., Reeves, D., Sun, W., and Bleiberg, J. (2007). Automated neuropsychological assessment metrics sports medicine battery. *Archives of clinical Neuropsychology*, 22(1), 101-114.
- Centers for Disease Control and Prevention (2010). TBI & Concussion. Retrieved from <http://www.cdc.gov/concussion/>
- Centers for Disease Control and Prevention (2007). Report to congress on mild traumatic brain injury in the United States. Retrieved from <http://www.cdc.gov/concussion/>
- Collins, M.W., Grindel, S.H., and Lovell, M.R. (1999). Relationship between concussion and neuropsychological performance in college football players. *Journal of the American Medical Association*, 282(10), 964-970.
- Covassin, T., Stearne, D., & Elbin, R. (2008). Concussion history and post-concussion neurocognitive performance and symptoms in collegiate athletes. *Journal of Athletic Training*, 43(2), 119-124.

- DeLee, J.C. and Farney, W. (1992). Incidence of injury in Texas high school football. *The American Journal of Sports Medicine*, 20(5), 575-580.
- Dennis M, Levin HS. Developmental, time and injury variables in the neurocognitive outcome of childhood head injury. *Dvpmtl Neuropsychology*, 25:1-4, 2004.
- Echemendia, R., and Julian, L. (2001). Mild traumatic brain injury in sports: neuropsychology's contribution to a developing field. *Neuropsychology Review*, 11(2), 69-88.
- Field, M., Collins, M., Lovell, M., & Maroon, J. (2003). Does age play a role in recovery from sports-related concussion? A comparison of high school and collegiate athletes. *The Journal of Pediatrics*. (546-553).
- Gessel, L., Fields, S., Collins, C., Dick, R., & Comstock, D. (2007). Concussions among united states high school and collegiate athletes. *Journal of Athletic Training*, 42(4), 495-503.
- Guskiewicz, K., Weaver, N., Padua, D., & Garrett, W. (2000). Epidemiology of concussion in collegiate and high school football players. *The American Journal of Sports Medicine*. 28(5), 643-650
- Guskiewicz, K., Bruce, S., Cantu, R., Ferrara, M., Kelly, J., McCrea, M., Putukian, M., & Valovich McLeod, T. (2004). National athletic trainers' association position statement: management of sport-related concussion. *Journal of Athletic Training*, 39(3), 280-297.
- Guskiewicz KM, Bruce SL, et al. (2006). Research based recommendations on management of sport related concussion: summary of the National Athletic Trainers' Association position statement. *Br J Sports Med* 40(1): 6-10.
- Hall, R. C. W., Hall, R. C. W., & Chapman, M. J. (2005). Definition, diagnosis, and forensic implications of postconcussion syndrome. *Psychosomatics: Journal of Consultation Liaison Psychiatry*, 46(3), 195-202.
- Iverson, G., Gaetz, M., Lovell, M., & Collins, W. (2004). Cumulative effects of concussion in amateur athletes. *Brain Injury*, 18(5), 433-443.
- Iverson, G., Brooks, B.L., Lovell, M.R., & Collins, M.W. (2006). No cumulative effects for one or two previous concussions. *British Journal of Sports Medicine*, 40, 72-75.
- Johnston, K., McCrory, P., Mohtadi, N., & Meeuwisse, W. (2001). Evidence-based review of sport-related concussion: clinical science. *Clinical Journal of Sport Medicine*, 11, 150-159.
- Kirkwood, M., Yeates, K., & Wilson, P. (2006). Pediatric sport related concussion: a review of the clinical management of an oft-neglected population. *Pediatrics*, 117(4), 1359-1371.

- Kutcher, J.S. and Eckner, J.T., (2010). At-risk populations in sports-related concussion. *Current Sports Medicine Reports*, 16-20.
- Lovell, m., Collins, M., Iverson, G., Field, m., Maroon, J., Cantu, R., Podell, K., Powell, J., Belza, M., & Fu, F., (2003). Recovery from mild concussion in high school athletes. *Journal of neurosurgery*, 98, 295-301.
- Makdissi, M. (2009). Is the simple versus complex classification of concussion a valid and useful differentiation? *British Journal of Sports Medicine*, 43, 123-127.
- McCrea, M. (2008). *Mild traumatic brain injury and post-concussion syndrome*. Oxford University Press.
- McCrea, M., Hammeke, T., Olsen, G., Leo, P., & Guskiewicz, K. (2004). Unreported concussion in high school football players. *Clinical Journal of Sports Medicine*, 14(1), 13-17.
- McCrea, M. (2001). Standardized mental status assessment of sports concussion. *Clinical Journal of Sport Medicine*, 11, 176-181.
- McCrorry, P. and Berkovic, S. (1998). Second-impact syndrome. *Neurology*, 50(3), 677-693.
- McCrorry, P., Johnston, K., Meeuwisse, W., Aubry, M., Cantu, R., Dvorak, J., Graf-Baumann, T., Kelly, J., Lovell, M., & Schamasch, P. (2005). Summary and agreement statement of the 2<sup>nd</sup> international conference on concussion in sport, Prague 2004. *Clinical Journal of Sport Medicine*, 15(2), 48-55.
- McCrorry, P., Meeuwisse, W., Johnston, K., Dvorak, J., Aubry, M., Molloy, M., & Cantu, R. (2009). Consensus statement on concussion in sport-the 3<sup>rd</sup> international conference on concussion in sport held in Zurich, November 2008. *Journal of Science and Medicine in Sport*, 340-351.
- McCrorry, P., Collie, A., Anderson, V., & Davis, G. (2004). Can we manage sport related concussion in children the same as in adults? *British Journal of Sports Medicine*, 38, 516-519.
- Meehan, W., d'Hemecourt, P., and Comstock, D., (2010). High school concussions in the 2008-2009 academic year. *The American Journal of Sports Medicine*.
- Oliaro, S., Anderson, S., & Hooker, D. (2001). Management of cerebral concussion in sports: the athletic trainer's perspective. *Journal of Athletic Training*, 36(3), 257-262.
- Notebaert, A., and Guskiewicz, K. (2005). Current trends in athletic training practice for concussion assessment and management. *Journal of Athletic Training*, 40(4), 320-325.
- Patel, D. Shivdasani, V., & Baker, R. (2005). Management of sport-related concussion in young athletes. *Sports Medicine*, 35(8), 671-684.

Powell, J., and Barber-Foss, K. (1999). Traumatic brain injury in high school athletes. *The Journal of the American Medical Association*, 282(10), 958-963.

Sosin, D.M., Sniezek, J.E., and Thurman, D.J. (1996). Incidence of mild and moderate brain injury in the United States, 1991. *Brain Injury*, 10(1), 47-54.

Thurman, D., Branche, C., and Sniezek, J. (1998). The epidemiology of sports-related traumatic brain injuries in the United States: recent developments. *Journal of Head Trauma Rehabilitation*, 13(2), 1-8.

Thurman, D., and Guerrero, J. (1999). Trends in hospitalization associated with traumatic brain injury. *The Journal of the American Medical Association*, 282(10), 954-957.

University Interscholastic League. Retrieved from  
<http://www.uil texas.org/health/info/concussions>

## Appendix A

### Questionnaire

1. School/District: \_\_\_\_\_
2. How many years have you been an athletic trainer? \_\_\_\_\_  
Licensed \_\_\_\_\_ [or] Certified \_\_\_\_\_
3. Level of Education (e.g. bachelors, masters, etc.) \_\_\_\_\_  
Field of study: \_\_\_\_\_
4. Date of Graduation: \_\_\_\_\_
5. What's your definition of a concussion?
6. How many concussions in **football only** were managed and evaluated this past season, between July 1 and December 31, 2010?  
**Total number of concussions:** \_\_\_\_\_  
Summer Practice: \_\_\_\_\_ Varsity: \_\_\_\_\_  
Fall Season: \_\_\_\_\_ JV: \_\_\_\_\_  
*Practice:* \_\_\_\_\_ Freshman: \_\_\_\_\_  
*Game:* \_\_\_\_\_  
Total number of football players: \_\_\_\_\_  
Varsity: \_\_\_\_\_  
JV: \_\_\_\_\_  
Freshman: \_\_\_\_\_
7. Type of field on which the athlete was injured:  
Artificial Turf \_\_\_\_\_ Natural Turf \_\_\_\_\_
8. What is the number of athletes that you suspected might have been withholding information about their condition/concussion? \_\_\_\_\_

9. How many of the above were referred to a physician for evaluation? \_\_\_\_\_

10. How many of these athletes went to the emergency room? \_\_\_\_\_

11. Which symptoms did you most often note from the concussions you managed? (Check all that apply)

- Headache
- Dizziness
- Sleepiness
- Irritability
- Emotional
- Slowed down
- Difficulty concentrating
- Visual problems
- Balance problems
- Sensitivity to noise
- Sensitivity to light
- Vomiting
- Nervousness
- Mentally foggy
- Nausea
- Fatigue
- Drowsiness
- Sadness
- Other (please specify) \_\_\_\_\_

12. Did you use a particular scale to identify and assess concussions, if so which one?

- SCAT
- ImPACT
- AAN
- Glasgow Coma Scale
- CDC Heads Up
- SAC
- Other (please specify) \_\_\_\_\_

13. After having determined an athlete had sustained a concussion in a game, was the athlete benched for the rest of that game? Yes \_\_\_\_\_ No \_\_\_\_\_

14. What are the factors that determine your decision to return a player to play? (Check all that apply)

- Asymptomatic
- Returned to baseline scores (neuropsychological tests)

- Passed balance tests
- Passed stress exertion tests
- Other \_\_\_\_\_

15. Who made the decision for an athlete to return to play following a concussion? (Check all that apply)

- Athletic Trainer
- Coach
- Team Physician
- Neurologist
- Concussion Management Clinic (UTEP)
- Parent
- Player
- Physician (personal/family)
- Other (please specify)\_\_\_\_\_

16. After how many concussions do you bench an athlete for the season? \_\_\_\_\_

17. Which symptoms did athletes report most frequently? (Check all that apply)

- |                            |                               |
|----------------------------|-------------------------------|
| ○ Headache                 | ○ Sensitivity to light        |
| ○ Dizziness                | ○ Vomiting                    |
| ○ Sleepiness               | ○ Nervousness                 |
| ○ Irritability             | ○ Mentally foggy              |
| ○ Emotional                | ○ Nausea                      |
| ○ Slowed down              | ○ Fatigue                     |
| ○ Difficulty concentrating | ○ Drowsiness                  |
| ○ Visual problems          | ○ Sadness                     |
| ○ Balance problems         | ○ Other (please specify)_____ |
| ○ Sensitivity to noise     |                               |

18. Are there any classes, presentations, conventions, or any continuing education you have attended or participated in, specifically addressing concussion? (within the last 3 years; check all that apply)

- Courses \_\_\_\_\_
- Presentations \_\_\_\_\_
- Convention \_\_\_\_\_
- Professional Organizations \_\_\_\_\_
- Online \_\_\_\_\_
- Journals \_\_\_\_\_
- Other (please specify) \_\_\_\_\_

19. How do you manage and follow-up on a concussed athlete?

20. Do you think it is important to educate athletes about concussions? Yes \_\_\_ No \_\_\_  
If so, explain:

21. Do you think that some athletes **DO NOT** report having experienced a concussion due to motivation factors? Yes \_\_\_ No \_\_\_

If so, check all the factors that may apply:

- Scholarship opportunities
- Starting player
- “being tough”
- Coach influence
- Family influence
- Peer influences
- Senior year
- Other (please specify) \_\_\_\_\_

## Appendix B

### Transcriptions of question #5 – Definition of a concussion

- 4.3.1 Altered mental/physical state due to blunt force to the head.
- 4.1.1 Injury to the brain that results in an altered state of mental status
- 4.3.2 Essentially a contusion the brain matter.
- 1.1.1 It is the sudden jolt of the brain inside the skull with the brain contacting a portion of the skull.
- 2.7.1 Pressure or compression of the brain within the intra cranial vault. Causing an influx of potassium and transient confusion.
- 2.7.2 Head injury that cause bruising of the brain.
- 3.2.1 A shake of the brain causing injury to brain with different symptoms.
- 4.4.1 When an athlete or person suffers a blow to the head and a change occurs either physically, mentally or emotionally
- 2.1.1 Bruise of the brain.
- 4.5.1 A blow to the head causing a disruption of the level of consciousness with mild to level 3 mild-being minor disrupt- feeling of "cobwebs" to loss of consc.
- 2.3.1 Any type of injury to the head that causes symptoms including (not limited to) dizziness, headache, blurred vision, loss of consciousness, etc.
- 2.6.1 Injury to head, which causes disruption to brain activity.
- 2.4.1 Any trauma or injury involving the brain.

- 2.2.1** A bruise to the brain usually as a result of direct trauma, in which cognitive and or sensory motor function is altered.
- 3.1.1** some type of head trauma/injury cause from hit or some force impact to the head.
- 2.5.1** When an athlete is unable to have full ability to perform due to a blow to the head. Unable to focus and concentrate with simple tasks. Does not have to lose consciousness.
- 3.3.1** Any injury to the head/brain that results in an altered state of functioning skills
- 4.2.1** Any trauma to the head that causes any s/s of a concussion to be present

## Appendix C

Transcriptions of question #19 – Management and follow-up on a concussed athlete

- 4.3.1 Exertional exam prior to releasing to play, followed by daily check. In before allowed to play.
- 4.1.1 Daily visits with athlete.
- 4.3.2 Check in daily to monitor status. Contact parents (no meds, 24hrs). Re-eval with exertion test. ImPACT testing.
- 1.1.1 Return to practice with limitations watching athletes actions, communication between athlete and coach.
- 2.7.1 Every 48 hours reassess - physician has to clear
- 2.7.2 they check in everyday until released.
- 3.2.1 Daily, on a day-to-day basis looking for improvement or more symptoms.
- 4.4.1 Speak with athlete daily. Re-evaluate tests (impact). Speak w/family.
- 2.1.1 They report to the training room daily until cleared in which time a note is given to them to give to the coach to return to play.
- 4.5.1 Follow Dr.'s orders if they have them. Check w/student athlete in morning and afternoon - to see how they are reacting and feeling
- 2.3.1 Day to day evals until symptom free- even after a Dr's release; Release by Dr. ; Notify coaches to watch for "funny" behavior after RTP

**2.6.1** Contact parents: try to have students check with us daily

**2.4.1** I always ask them for updates on their signs and symptoms every day for several weeks, several after returning to play

**2.2.1** 1. Ask athlete if any symptoms persist. 2. gradually increase the intensity of their physical activity starting from waking up to actual drills and conditioning. The athlete must be symptom free at one level in order to progress to the next level.

**3.1.1** SAC re-eval or until asymptomatic

**2.5.1** Daily check with trainer, during sports class

**3.3.1** Continually assessing symptom conditions monitoring future symptom during play.

**4.2.1** Athlete checks in w/LAT on a daily basis.

## Appendix D

Transcriptions of question #20 – Why it is important to educate athletes about concussion

- 4.3.1 its more important to educate the kids because they're less likely to uh, report if they don't understand what second impact syndrome is and all that kind of stuff
- 4.1.1 If the kids don't know the consequences, they are less likely to report concussions.
- 4.3.2 Vital for them to recognize s/s not only in themselves but in their teammates.
- 1.1.1 Athletes respond to questions more openly if they know what is happening and why.
- 2.7.1 So that they know the signs and symptoms and warnings.
- 2.7.2 They need to know how dangerous unreported concussions can be.
- 3.2.1 To make them aware of symptoms and dangers about concussions that are not treated correctly.
- 4.4.1 So that they can see the severity of the actual injury and what it can cause.
- 2.1.1 Communication is the key due to athletes and parents not knowing what a concussions.
- 4.5.1 Very much so. After seeing some of our athletes in the past and the kids knowing then they realize it. Also showing them videos of actual athletes that have suffered concussion and their final diagnosis.
- 2.3.1 Most people don't understand the severity of one concussion. I fell it is important to educate athletes, coaches, and parents so they understand the risks of concussions as well as second impact syndromes.

- 2.6.1** I think parents as well as athletes need to be more educated. There is a tendency for these individuals to not realize the severity and consequences of these types of injuries.
- 2.4.1** Absolutely, we can and must inform athletes parents, coaches, and medical community about the significance of concussions and importance of reporting concussion and treating concussion.
- 2.2.1** Athletes need to be educated as to what a concussion actually is, the symptoms that can occur and the possible consequences of returning to practice and or competition to soon. Parents need to be educated as well.
- 3.1.1** I think athletes need to know about, know what happen, and the risk that come with it.
- 2.5.1** If they understand the symptoms and the seriousness of the problem they will be more likely to report the incident.
- 3.3.1** so many times the kid don't understand the long term effects it is about the desire to play , they need to understand all the possibilities of the what can happen and the game is only temporary.
- 4.2.1** Concussions add up no matter their severity.

## Appendix E

### Audio Recording Transcriptions

#### 4.1.1

ATC: Coach Brown, you know how many concussion we had in football

Coach: 7 or 8

ATC: I think it be more like 10, to be honest, ima put 9, an average

ATC: It was all pretty much all fall season, we don't do summer at all, we are off 6 weeks in the summer; (to Coach) "do you have the tally sheets where you wrote the concussions down" – we actually keep records so I will be able to tell you and look at it for you

PI: Perect

ATC: How many were practice how many were game?

Coach: I don't have it broken down that way

ATC: Ok, how do you have it broken down, jv, fresh, varsity?

Coach: Uh... went to doctor. Uh..

PI: Those questions are further down

ATC: Ok, (to coach) how many were referred to a physician?

Coach: Uh.. (Muffled)

ATC: If we only have 9 how many went like how? We have had 40 concussions in all athletics, isnt that crazy.  
I would have to go and look up and physically pull out each document and we could have tallied it. I wish I would of known and I would have had it prepared.

PI: I could leave the questionnaire and come back, or you can look it up and we can reschedule to finish it up.

ATC: Well... I'm saying we had 9 in football and say it probably half and half, I would say more practice than game, I can't give you exact numbers but I can estimate. With football I would say nine

PI Specific to football

ATC: With football out of our nine, Varsity, most of mine were varsity, I would say its more like 2, and then like that (wrote 2 under JV), and then 5. Because most of them are varsity, I have gotten a lot of hot water with the coach

PI: Do you happen to know the total number of athletes, in football?

ATC: Total number is about 250, oh I was supposed to put that over here

PI: Yes. Sorry about that

ATC: Varsity, ... (asked Coach) actually we only had, freshman. Small, they were about, not very many 80, hes the one you should be asking all the questions!

PI: He is the coach?

ATC: My partner, he does all the tallying... ok lets add that up, 135...

PI: 250 minus 135

ATC: About 115 for jv - it about, its close I'd say

PI: Do you guys play (pointed)

ATC: Both actually. Practice, uhm practice is natural and then we play games - and varsity only varsity games, and if we play at el paso most are turf, versus ysltea schools are all natural

PI: Thank you for that.

ATC: Ok, it says what is the number of athletes you suspect are withholding information?

PI: Uh hum

ATC: Essentially from these, of just football of percentage?

PI: No just a number

ATC: Uhm. I would say uhhh, well there were 9 I would say at least double that, probably 9 or so.

PI Of the number up here

ATC: Of the 9, it was 5, I think it was about 5, 4 or 5

PI Referred to physician would they be the same for emergency room

ATC: We had one that we sent by ambulance to the emergency room the rest where. (to coach) "Did we send any of our football concussions to physician?" ok I know we did take one freshman by ambulance. The rest we had the parents take them home and watch them and all that. Did you find them (to trainer)?

PI This is actually the tallying that yall do

ATC: This one and this one would be our most common, headache and dizziness

PI: Ok

ATC: We probably saw quite a bit of this one. We had a cheerleader. O this is football. . . We had a lot of volleyball players with concussions, in one tournament

PI: I am sure, I wish I could address every sport but this questionnaire is specific to football that would be my next study.

ATC: Ah, good luck with that!

ATC: Most of the athletes their sympoms are completely gone within the next 24 hours, and these are the most common I would say. Only the ones that tend to have a longer period of problems start showing more of these,

PI: Perfect, thank you.

ATC: We do. We use the impact card, for testing some, and then we also use kinda a combination of the its uh the SAC, just because I like the way its broken down and asks questions and also has to do with the physical stuff.

PI Uh huh

ATC: So I would say those are probably are most common

ATC: Absolutely! - I had a kid who was a soccer player and she got hurt in a tournament and she is not allowed to play. She was given a doctors order to stay out for 3 months, the very next day her soccer coach sees her running out on the track, and I am like NO! No no no, but because the note from the doctor said 'no soccer' and it didnt say no running - so i asked her if she was having symptoms and she said yes and ugh i had a fit.

PI Wow. With continued symptoms.

ATC: We need to think about baselines for all sports. - This would be one, and asymptomatic for sure, and we do the 5 day return to play.

PI: OK.

ATC: Ok, and that's just in general?

PI Yes in general

ATC: Ok, its either the Athletic trainer, or a doctor of some sort, not our team physician - we have had a couple of that where we use yalls clinic and Dr.Islas, and I will put we follow guidelines of a medical doctor.

PI: Ok, put that under other.

ATC: That would be 3

PI: This question is what the athlete actual reports to you.

ATC: And what is different from this one?

PI: What you directly ask them and note from their concussion

ATC: What I would note, uhm because if I, If I would notice just things and I do ask them, all these.

PI: Ok, just answer the ones they state to you

ATC: I jot down all of these. I notice of they are queasy on their feet, if you can call it queasy on their feet.

PI: Ok, I want the ones they report.

ATC: Specifically then, they report these three.

ATC: And what is different from this one?

ATC: We got our athletic trainers symposiums and we talk a lot about concussions, and of course at Ft. Davis we got a conference every year and we do that, then of course we had yall come down and talk and do the one for coaches, I participated at that as well. Uhm, and most of our journals have quite a lot; it's a big topic right now. Uhm. - Daily visits with the athlete. - Absolutely - So that one I think, its more important to educate the kids because theyre less likely to uh, report if they dont understand what second impact syndrome is and all that kind of stuff. - Uhm a lot of kids are afraid to tell us because they are afraid that we are going to take them out of the game. This would be one of them; they think that uh, well another one would be coach's influence. - Another issue is taking the kids to do the impact and they think that it will just go away at their own pace when the tests tell us if it does or not. I had to fight off a parent, and it is hard when the Coach is not on my side as well.

ATC1: Should I answer these questions?

PI Which ones

ATC1: Here on the number of athletes because we should have the same.

PI Go ahead and only one of you answer those questions but I would like for you to answer the rest of the questionnaire if you follow and use different guidelines or have a different way of managing and evaluating a concussion

ATC2: Yea we are different because I use a combination of the SAC and ImPact.

We are different on how we do our initial evaluations.

PI: Ok, then give me your raw numbers from only one of you but answer the following questions.

PI: Your names will not be used, how long have you been here?

ATC2: A year and a half, I was at UTEP before this.

PI: O really?

ATC: Yeap, I was the GA there for 2 years.

2

Do I count undergrad, while I was in college?

PI: Answer the how long you have been certified or licensed

ATC2: Well it will be the same. Licensed for 1 1/2 years and certified for 5 years

I did my bachelors in athletic trainer and masters was exercise science

PI In month and year please

ATC2: Definition of a concussion. Oh god.

PI: How would you define it?

ATC2: Its essentially a bruise to the brain

B-R-A-I-N, that how you spell it? I always mix it up with Brian.

PI: Yes brain.

ATC2: Total number of football players, oh god! - (To ATC1) Dude, how many did we have this year? Like 250?

ATC1: Uhm.

ATC2: Hmm, we had like 200 freshman,

PI That's gonna break down, into varsity, jv, and freshman

ATC2: Geez, I'm trying to remember how many each we had... well ima say, 60 on varsity cuz that's how many we took to Midland, 200 freshman, and I wanna say its like uh I wanna say like 40 on JV, so then its like 300

ATC2: We play on both natural and artificial

ATC1: 300 players

ATC2: Well we had, like varsity one happened on artificial turf and one on natural the jv on natural turf and the freshman all happened on natural turf

PI: Ok, lets break that down, so one happened here, one varsity there and one here and here there ya go.

PI Was it all seven

ATC2: I would say uhm, 2 of the 7. Hmm. Brya went to the physician; did Bryan go to the hospital? (to other ATC)

PI: Well that question is for a physician and the following question is if they went to the emergency room.

ATC2: Ah huh  
To himself - what was the other the s...

PI: The SAC?

ATC2: Oh yea, thanks

ATC1: Definition. Uhm.

ATC2: Want to hear mine? contusion of the brain matter.

PI: If its not a team physician but an MD, go ahead and put that under other and then specify it for me

ATC2: Ok.

ATC2: On this question on after how many concussions do you bench an athlete for the season, I mean it depends on the severity

PI: Go ahead and put that. Generally, though would you go off a number?

ATC2: It depends, and we go by the standard, if you have three grade ones or a grade 2 you pull them out for so long and a grade 1 they are done  
Mainly what we saw, and ima say 3 cuz we didn't have any grade 2's

PI Those are the ones the athletes actually report

ATC2: Ok.

ATC1: These are the ones I note?

PI: Yes so when you assess, it is the symptoms you ask them

ATC2: (To other atc) they did something at SCATA last year didn't they for concussion?

ATC1: Yea

ATC2: What was the other we had just this year, right before uh, well Dr.Salvatore actually spoke at that one

PI: Was it the Sun City something, for coaches?

ATC2 I will just put SISD conc meeting

PI: You can also put CMC meeting

ATC1: Whats the name of that scale?

ATC2: You use the same thing I use, a mixture of the BESS and SAC testing

PI You can put that in other, combination of and then name them

ATC2 Our coaches are actually very compliant, I mean it varies but this whole season they were for the most part

PI: You're lucky, there are many who do not like to adhere to the recommendations made

### 1.1.1

PI: So that would be this past season only

ATC: Mmhmmm

ATC: I think we only had 2 - no 3

PI: Where they during the game or practice

ATC: This one was game, this one was practice, and that one I don't remember

PI: This is the total number of football players

ATC: I don't remember or if they will match up but we ran 150 kids this year

PI: All 3 were artificial?

ATC: Yes, this one here was out at Gadsden, and this one was at home, but like I said I don't remember if it was practice or a game

PI: Ok, of these 3 do you suspect

ATC: None of them were

PI: Was that the same one?

ATC: Yea, he was hauled off in an ambulance

ATC: To be honest with you, I really didn't use any of these, I mean they were cut dry, they were

PI: You knew they were concussions

ATC: Not to be mean but it was one of those funny stupid ones. And the freshman was hauled off because we also suspected a neck injury with him

PI: Ok, let's go ahead and put none in the blank (check other)

ATC: What about a team physician?

PI: Was this a personal like a primary type thing

ATC: This was that freshman, cuz he went to the emergency room and then that screws up everything with medicaid because of course they get out of their comfort zone uhm but it was this this was actually a neurologist that cleared him

PI: Just put that there.

ATC: I've done some stuff online, but I don't use one site, I just use google and arrange the words how I want them

PI: Let's put.

ATC: Search engine?

PI: Yea search engine will work'

ATC: I wish I could remember the name of that journal

PI: There are so many

ATC: Oh, it's an old one that I did a lot of research on my first or second year down here.

ATC: This one is specific to sports medicine. . Uhm ok...

PI: How about coach influence?

ATC: Not here. I will be honest as far as my coaches go I am in an ideal situation, if I say this individual can't play it is what I say

### 2.1.1

ATC: Practicing or athletic trainer?

PI: Practicing

ATC: Date of graduation?

PI: Just month and year.

ATC: Aug-97

It all depends, licensure in the state of Texas has been around longer than the national certification has been, in fact this is the first year, for example, the girl that works with me she didn't have to take the licensure exam, she just had to go online and take the laws . . .

This is strictly a guess because without going back through every kid's file I have no way to do this exactly, summer practices I was not here.

PI: Well, I can return.

ATC: Hmm, what is your definition of concussion? The problem here is that I had a kid, who had a panic attack, and he went to the ER and got a diagnosis of a concussion a vertebral fracture, a kidney bruise, and then they said he was cured.

PI: When he came back did you keep your eye on him as per the concussion diagnoses or you didn't manage him

ATC: Once they are under the care of a doctor it is pretty much their decision.

PI: So the ones that you would say, or that you documented.

ATC: 2... JV... 2. Freshman we had 6...

PI: Of those were they practice or game.

ATC: Practice that was 3 so then...

ATC: Total number of football players. Waaaa... let's see we should have.

Coach: Walked into the room, 1--- I would say about 175,

ATC: Varsity?

Coach: 45

ATC: JV?

Coach: 45

ATC: And the rest freshman

Coach: You can break them down into a and b c teams

ATC: No she just has them as freshman

ATC: Natural turf does that count as rocks.

We just got brand new track, they preped for the turf but it hasn't happened.

ATC: So you want a percentage? Or actual numbers

PI: Actual numbers.

ATC: So what I document?

PI: Yes, what do you ask though?

ATC: Well basically, it is hard to lead them into it without giving them.

PI: Ok yes, and later on the question will be regarding what they come forth with, without being asked.

ATC: Ok, so even if they report when I ask.

ATC: (reading) after having determined... do you bench an athlete for the rest of the game? Yes, and no, I mean it depends on the symptoms.

PI: Ok, so, I will document that, and depending on their symptoms, you mean what by that?

ATC: Well, UIL states if a kid has a concussion and comes out and got hit, got dizzy, according to UIL they got a concussion, if those symptoms are clear within 15 minutes and it is the first time they got a concussion then they can return to the game.

PI: O, ok. I will note that.

ATC: Does that make sense? Where as, if loss of consciousness comes out 1. They are transported to the hospital and 2. Well they don't return to play

PI: Ok.

ATC: Well that's a two-sided question. It goes both ways.

And this one, return to baseline scores, that doesn't go, all we have to go by is what each individual kid is like and that's how we work things out.

And if you don't know them, I mean the kid can just not have good balance, so you might set the kid out for a head injury and might just be clumsy

PI: Well that was there because we offer the Impact testing from UTEP and some ATC's participate in that program

ATC: Check all that apply?

PI: Uh hum

ATC: It just depends, I really can't answer this, "after how many concussions do you bench an athlete?" it depends on how severe the concussion is

PI: Well is there a guideline, like UIL, some have been telling me that.

ATC: Correct, because #1 if its loss of consciousness, there is a good chance they are out for the season, I mean I will give you an example, I had a freshman football player this year, sustained a concussion, didn't bother to say he sustained a concussion, then sustained a second concussion, uhm, trainer at one of the schools I don't remember which one, but the parents told them it was the second one and I knew nothing of the first one, so we had to explain - his doctor's office cleared him to return to sports in a week, he was still having headaches. So I saw the doctor's note and it was signed off by a physician's assistant, not a physician. So I was the bad guy and called the office and they said that it is not valid and he has to see the doctor. He was then signed off to go to practice but not the season. Being a certified athletic trainer in the state of Texas, if the doctor clears the athlete to play then we are obligated to follow that, but when its not a doctor then we are obligated. SO I am going to answer that one with it just depends.

Well balance, they don't think they have balance problems...

PI: Did they say it, then you put it, on the previous question is when you put the symptoms you actually ask.  
ATC: Ok.  
ATC: Alright, you wanna go through it and check if I answered correctly, on this one I don't think that the lack is a motivational factor, its education, its knowing that educationally there are downfalls. Because it they are educated and they know they have a concussion and they are a starting player they are not going to tell you. It s a double sided sword, because if you teach them when theyre young theyre going to tell you and their final years theyre not going to tell you. Thats when we gotta get the student and coaches on the same page, say so and so is this or whatever they see. But I marked no, educated is why.

#### 4.5.1

ATC: I been wanting to set up a time to get them baseline scores with the new teams  
PI: Can you put the month for me there  
ATC: August  
ATC1: Hello  
  
PI: Nice to meet you  
ATC: You can help me answer some questions  
PI: If you want to say it, I can transcribe it  
ATC: Its ok.  
ATC: How many football concussions did we have this year? (To atc that walked in)  
This past season so we had 9 or 10 didn't we  
ATC1: Yea, most of them were practice  
  
ATC: JV I know we had, well freshman we had nobody, JV we had  
ATC1: Robert and uhm, we had like 2 or 3,  
  
ATC Most of them happened at practice, did one happen at a game  
ATC1: No they were all practice  
ATC Total number of football players  
ATC1: Oooo...  
ATC: When we started with a lot but ended with.  
ATC1: Freshman we had 18.  
ATC Yea 18  
PI: That's a little bit  
ATC1: yea, they opened up Eastlake and they took a bunch of our kids there, they opened up enrollment  
ATC: How many kids on JV? 30?  
ATC1: about 34  
ATC: and how many varsity

ATC1: I counted about 44  
ATC: 34, 44, and 18?  
PI: 96  
ATC: Natural turf, dirt!  
PI: those are the ones from the total how many withheld information  
ATC: o, none, they are all really good. We show them a video and since then they have been very honest  
PI: that's really good  
ATC: a couple of years ago we had a kid, skull fracture with a concussion at a scrimmage and ever since then everyone has been really good at telling us whats going on  
ATC: How many were referred to a physician?  
ATC1: for the head?  
ATC: for the head. 2?  
ATC1: no because they werent bad, we did Robert, uh,  
ATC: cause of his previous history  
ATC1: and cause he lost consciousness  
ATC: and only one to the emergency room  
ATC1: you know, they label it a concussion, but they don't consider it because they don't consider it unless they lose consciousness but you can just see the glaze in their eyes.  
this is what we give them..  
PI: can I have this?  
ATC1: yes sure  
ATC: not applicable  
PI: would you though  
ATC: ok, absolutely, will do, so I will put will do  
ATC: take their helmets  
ATC1: we actually hide their helmets  
ATC: we actually don't have those  
ATC1: yea and a lot of times when they go to the ER, they get a note saying they will be good in a week. But in reality they are not good in a week  
PI: Yea, everybody is different, and some may heal in a day and some may take 2 weeks.  
ATC1: Ah, we sent two to the doctor.. Remember  
ATC: oh legerreta, oh yea.. That's right  
ATC1: this kid we sent to the doctor  
ATC: he played football first then went to wrestling

ATC1: he got a concussion in football, send him to the doctor, the doctor held him out for like ten weeks, and he was good to go in 2, but the doctor..

PI: said no

ATC: check all that apply. Hmmm...

ATC1: you can put team physician, Dr. Diaz is there.

ATC: yeah - uhm, Dr.Diaz

ATC: You want me to write down what they were, or no?

PI: yes please

ATC: Symposium.. There..

ATC1: Yeah

ATC: we make them come in everyday, morning and afternoon to check in with us.

ATC: we had one studnt that was having trouble in class, he was falling asleep, and we had to talk to the teacher, we should have done a 504 on him

ATC: We had a few bad ones, and one that happened has made everyone concerned. We use the video on ESPN, E60.

#### 4.4.1

ATC: I just say it to you...

PI: No, fill it out. I am recording for future use and transcribing in case anything is left out or if it is said and not written down.

ATC: I'm bad at explaining things.. Ok.. This is my how many years.. Hmm.. ok, I hope I explained that right..

How many concussions... uhm.. It was a few, ima say 3 at the most. they all happened in a game, and just freshman.

PI: That is actually the total of players on the team

ATC: o, 84.

Do I put how many were on each or just check if they happened on that type of turf?

PI: put the number of those

ATC: I think it was one on truf and 2 on natural

They don't want me to take them out of the game. So all of them.

I had a bad one, but last year, I had to go with him to the ER. He was really bad. Fainting, couldn't remember anything

PI: ok, this question is the symptoms you ask and note most frequently.

ATC: What do you mean here?

PI: in the season, is there a number like 2 and then you bench them for the season, not just the game.

ATC: I didn't have one that I did bench this last season

PI: in general, something you go by?

ATC: Ok, well I would say it depends on the severity, but I mean if they have 3 then I probably would, like a 3 strikes your out kinda thing.

I'm actually on the board with SCATA. We are trying to come up with a guideline or something that everyone agrees on about concussion, and tests to use.

Older athletic trainers have a different understanding of concussions. I mean, me, I am more on the side of taking it serious, You only have one brain ya know, that's it, you cant replace it. I tell the kids and when they don't wanna listen I have to talk to them that it is serious, the video that they showed is a good video to use and show them because it makes a difference.

I've seen some pretty bad ones when I was in college, so I know that it can be very serious.

I don't know if this makes sense... Sorry, I have a hard time explaining myself. I think of one thing and it doesn't come out the way I want it.

### 3.2.1

PI: How long have you been an athletic trainer here?

ATC: I am on my 8th year.

PI: This is just football.

ATC: Ok

PI: just making sure.

PI: if you can further break it down.

ATC: We don't have freshman

PI: ok, here ..

ATC: got it

Total, varsity and JV..

PI: Yes, then break it up..

ATC: We are a small school now, we are 3A now.

PI: All 4 of them were on natural turf?

ATC: uh huh

PI: Ok

ATC: o, you know what, one of them happened on artificial, it happened at Bowie and they have the new..

PI: From these four ..

ATC: yea

PI: So these are the symptoms that you ask them

ATC: ok

ATC: Do you have a headache, do you this?

PI: yes.

ATC: This is from my school right?

PI: Yes  
ATC: Because I had one from another school.  
ATC: I don't remember the name of the one I use. Are you familiar with them?  
PI: Yes.. Describe it to me  
ATC: It has a little card  
PI: Well, they all have some kind of card what does it have on it, which color  
ATC: uhm  
PI: Well there is the one the Impact and it has the little brain and head  
ATC: Yea that's the one  
ATC: This is what they tell me  
PI: Yes.  
PI: On that one, can you tell me why, you put yes.  
ATC: Ok

### 2.7.1

ATC: I'm finishing my Masters, so should I put masters?  
PI: Well you are practicing now, what are you now? Put the current level  
ATC: I am almost done!  
What did I study, hmm a bachelors in science  
PI: Well put what you got it in.  
ATC: Definition of a concussion? A head injury, haha  
PI: haha  
ATC: A head injury that happens to damage the brain. SoI fill all this out here?  
ATC: this past season in football only? God, I didn't really have.. That I personally dealt with, I had 1, J had a lot more  
And I only deal with Varsity, and I only dealt with one. And it was bad, he came out and said, "who are you" ..  
PI: Ok, then you tell me how many you had just here on varsity team  
ATC: (To student athletic trainers), How many players are on the football team?  
Student: How many football players  
ATC: varsity  
Student: 60  
student2 50  
ATC: To students, how many concussions did we have on varsity, that I took care of  
Student: 10  
Student2: well 15 ish  
ATC: stop throwing numbers, really  
Student : it was a little bit, JV was a lot  
ATC: you cant remember a number?

My kid got hurt on artificial turf

PI: These are the symptoms that you ask them.

ATC: well I don't ask, but I can see that they are sensitive to light.

PI: Ok, put that because it is what you note

ATC: whats the name of that stupid scale we use?

we don't have any psychological test

I don't know if the kid saw a neurologist

I have a concussion in volleyball

This is what the kid is telling you?

PI: yes, what he actually reported to you.

ATC: How do you manage on a... well they don't practice for like two weeks.

### 2.6.1

ATC: you want the school or the district.

that's a complicated question, 1989

PI: oo, 89-99-09, 22

ATC: How elaborate do you want it

PI: just tell me your definition

ATC: I'm just making a guesstimate here, I know of one for sure.

PI: Here then you would break it down for me by level.

ATC: theres not a category for dirt?

ATC: Like I said, I'm making an approximation here.

ok, it kinda gets redundant here

PI: no, that's the total number of players

ATC: once again, this is a guesstimate, its uhm..

now I gotta count backwards

after how many concussions do you bench an athlete.. I mean it varies

PI: Go ahead and put what you follow, if there is a guideline you go by

ATC: I mean there is the standard of 3, depends on the severity

PI: Definitely, so I have been putting both, if you will write that in for me. - I am sure if it is extremely severe you would keep them out.

ATC: Is it Bak, Fjordbak?

PI: yes

Alright, let me just make sure.

### 2.3.1

ATC: Do I need to read these aloud?

PI: No, just go ahead and answer it, I am here just to make sure you fill everything out or if you have any questions.

ATC: The number of concussions.. Let me think.  
Football only?

PI: Yes, football only.

ATC: I am gonna put 4, I have 2 there but I know I had two others  
We used to do the testing  
Is it ok if I guesstimate on the total number on the team? Because I don't know each team. I am basing this number off the number of physicals turned in, I look at these numbers, I know I didn't have 80 varsity players and after the season it changes.

PI: That's fine.

ATC: My partner was telling me, I don't know if you have heard about it, I don't even know but he was telling me about it. That Bears player that comitted suicide and left a note saying to not forget to donate his brain to the research. Now they are taking the slides of the brain and showing this protein in their brains, and if you think about it. You have been playing 15 years of football, and havent reached the level of NFL, and the damage is done, theyre showing that even if you dont have a clinically diagnosed concussion, every little hit you take adds that protein and it keeps adding up.

PI: Yea, Dr.McVay is her name I believe. She has been doing that work.

ATC: Yeah, we were using Dr.Salvatore for the testing, and I don't know why it's a big issue, but they found out, uh, there was a big stink because I guess he didn't go through the proper channels in the district and they don't want him on our campus

PI: I don't know, I havent heard that.

ATC: I don't either, I'm thinking, that whats happening, that impact testing - I've seen the numbers on it, I saw the presentation on it. I am a firm believer on using it, also having had a concussion before and going back to soon, I don't they understand. I dont know if you have seen that video, E60 video, that kid who went back to soon, he was basically, i mean he had to learn everything back it was like he had a stroke. Its a good video, and if they knew what he is doing with the impact testing they would have held him out, I mean we get kids that we hold out for 2 or 3 or 4 weeks because they are not back at their normal and we keep them out for a month. Coaches are throwing a fit because we keep them out for a month, and isnt it the health that we are concerned about? It became a big stink.

PI: There have been people who mention it, but I am not sure, like I said I havent heard anything

ATC: here it says after how many concussions do you bench an athlete for the season, it depends, we never really ..

PI: I have been getting that it depends on the severity, but is there maybe a guideline you follow?

ATC: we don't have one. I mean it really depends, so Ima put it depends on the severity, cuz if you have a kid that is out for 5 minutes hes done, his season is over, he is turning his equipment in. I mean, you know if there is a kid..

PI: You can put that for me.

## 2.4.1

ATC: I will try to make it so you can read this.

PI: and I am recording in case

ATC: I have been certified and licensed , well didn't get my license until I moved to Texas.

ok, I just finished my phd, so I put...

its actually education

PI: yes put what you studied in

ATC: my definition of a concussion, that's a good question, see they define with headaches and stuff, but uhm, you know it can be any head trauma any brain injury - how is that, any trauma or injury involving the brain

PI: if that's your definition, it works

ATC: Is that alright?

PI: that's alright

ATC: How many concussions were managed... football only... I don't know any of the summer I wasn't here. Ok, so starting fall season.

PI: put the six there too

ATC: (looking at notes written) practices or games, good question.. I know one was practice for sure, the other 5 were games.

this guy was... (to self)... and he was.. So only one.

I don't want to guess, I believe in accurate information, ok, every one of these guys played varsity but theyre not all varsity, I mean some of them are sophomores, so.

PI: Well if they are on the varsity squad

ATC: Total number of football players, wow. Let me see, let me call the head coach (making a phone call) I just want to give you the most accurate information I can normally I keep the roster this year I didn't. Dang it hes not answering, - I can call you on this if you want.

PI: That is perfect, you can get back at me.

ATC: want me to do that then, just leave it open for now

PI: yes that's fine.

ATC: I was gonna say 84, but I wanna be sure, we had a lot of freshman.

god, that's a good question..hmm.. Artificial, but we play more on the natural turf. . Actually that was 3, and well canutillo, \*\*\* his was ... 2 of the 3... \*\*\* his was for sure artificial, \*\*\*, \*\*\*? Hmm..

ATC: I'd say at elast 10, I mean some of them didn't report it until later and that was with a lot of pressure. .

some of them did report.. You know.. Hmm..

ima put 12..

all of them..thats the advantage of having a team physician.. ER, hmm.. \*\*\* was the only one, one of the six -

Some of these like sleepiness, and well I think I did ask these..

I'm just impressed that you arent an athletic trainer and youre running this research..

PI: Well, we have the clinic and the area of TBI interests me dearly, especially sport related.

ATC: I wish, (neuropsych tests), the people we have the physicians, they do these tests, should I put the ones they used?

PI: No, put the one you use..

ATC: This is the one I use, always cuz it so easy

PI: The UIL, put that under other, and write it please.

ATC: after having determined... yes... asymptomatic absolutely!

I do my own neuropsych test, the romberg, we have them balance, we have them walk a line, stuff like that. I cant say I did that though because we don't have a baseline, I know Dr.Islas was pushing it and by the time we got it approved through the district, it was too late.

PI: yes, they make everything so hard.

ATC: That's what I really notice the inability to concentrate - push ups, sit ups, .. We even over rule the doctors

PI: Really? That's good.

ATC: The one that concerned me the most, we had this guy who, he is goliath, and he got his bell rung so bad, I mean pretty seroius grade 2 even grade 3, I mean he lost, based on this scale he was a grade 3 cuz he lost consciousness, the physician and doctor and they said absolutely nothing for one week, maybe even two, mom was on board in fact she was upset that we didnt call her immediately- to let her know, we actually waited till after the game. we were making sure, re assessing and didnt want to create panic. Well she kept saying I refuse and he will not play next week no matter what, and game day came and guess who was the one pushing for him to play?

PI: Her?

ATC: Yes, I was so shocked, the one who was pushing for him to stay out was now, oh my.

PI: wow

ATC: We want them to be completely healed, I mean do you want him hurt again? And you know sometimes they don't say anything, I mean the other athletes may even know but nothing is ever said.

you find out about it later on and.. Well. Its frustrating.

You know on these, well they report irritability but its half and half, and you want most frequently reported..

PI: Put the ones you note and get everytime, more than the others.

ATC: Ok, well I have done, because there have been courses and presentations at those conferences..

PI: Go ahead and write the conference attended.

ATC: Want me to specify which ones then?

PI: Yes please.

ATC: signs and symptoms

PI: Is there an amount of days that you do?

ATC: every day... so you want the frequency and all of that.

PI: Yes, everything you do for how long you do it  
every day for several weeks, even when they return to play  
Not just the athlete, you need to inform parents, coaches, (mainly they put so much pressure on the kids, medical, I think we all need to be in there talking together. Alright.

### 2.5.1

PI: If you don't understand something, I am here to clarify or explain

ATC: just raise my hand? Haha.. Ok, do I need to write out the name or I can abbreviate the school district?

PI: abbreviate is fine.

ATC: ooo, I am a dinosaur, licensed or a student/

PI: licensed.

ATC: wow youre making me think, and feel old!

PI: Just in football.

ATC: Yes, I am thinking..

ATC2: Last year we had one every week!

PI: every week?

ATC: I am trying to figure out who and where at what level.. I remember in the game. And we had some in the practice.

ATC2: I would say there was maybe two in practice

ATC: its 6.

ATC2: there had to have been one game where we had 2

ATC: we didn't send any freshman.

How many did we send to the emergency room? \*\* and \*\*\*.. 3?

ATC2: 3 at least three

ATC: \*\*\* for sure, the big lineman. And who else in a game, that we sent, oh my lil jv dude

ATC2: really?

ATC: you know another varsity

ATC2: I'm thinking receiver

ATC: emergency room was it just 2

ATC2: I think it was just 2, I remember sending \*\*\*  
PI: that's the UIL one?  
ATC: yes  
PI: go ahead and put other then list it there for me.  
ATC: the last three years, hmm everyone we have gone to talks about, everything someone says something about concussion  
PI: Put the name of the conference you don't have to put the presentation exactly unless it was just a presentation you went to  
ATC: Did we have the SCATA meeting in May?  
ATC2: last night? I cant even tell you...  
ATC: I know they talked about it in Ft. Davis.

### 2.2.1

ATC: I can write YISD right?  
PI: yes, that's sufficient.  
ATC: Summer practice? What do you mean by that?  
PI: June, July  
ATC: there was none of that.  
PI: then put 0 there.  
ATC: fall.. It was half for game and practice  
I'm approximating.  
they were all on natural turf?  
I'm pretty sure.. No wait, actually on was on artificial, we were in that kickoff classic in san antonio and one of them happened there.  
ATC: How many we referred or how many actually went?  
PI: that's a good question, that's a first. Lets do both, you referered all 4?  
ATC: I referred all 4.  
PI: and how many went  
ATC: I think 3 of them  
hmm. Now one I think went to the ER, and the rest went to the doctor, but they did go see a doctor  
PI: then for ER just one  
ATC: I really didn't use any of these, so  
PI: did you use...  
ATC: I used my own evaluation procedure  
PI: put it under other there.  
ATC: now, question 16, it says how many concussions do you bench an athlete for the season, my question is, how often do they occur -if its like the 3rd one in three years  
PI: Well is there a standard you go by or if it depends, then go ahead and put that

ATC: I would say 3, depending upon the, what do you call - how soon apart, know what I mean  
PI: Yea, go ahead and put that for me.

### 3.1.1

ATC: varsity, varsity, varsity, that's 7 varsity  
PI: that will be later  
ATC: one was moved back and forth.. But he was mostly varsity.  
PI: Ok, so in total 8, put that for me here  
ATC: we didn't have any injuries this summer, last summer we had a few.  
PI: no, just this summer, for fall season put 8 and then break it down for practice and game.  
ATC: ok, this is game, game, game, game, practice, game, game, practice, so 6 and 2, and one wasn't even practice it was pre-practice, they were screwing around.  
ATC: ok, almost 8 years.... And kinesse, how do you spell it... uhm, what did I say, dec 02, uhm.  
artificial...  
PI: all were artificial  
home home \*\*\*\* home, home, home, I think that was grass...  
PI: so put one there and 7 there  
ATC: I would say 10 throughout the season.  
PI: ok that's good  
ATC: how many from the above were refered to a physician, 5, 1, 2, 3, 4, 5, and he went to the doctor, so five, how many went to the ER, he went to the doctor, he went to the doctor, he went to the doctor, he went to Beumont  
PI: did he go to their ER or just to the hospital.  
ATC: I don't know, but that one went to the ER,  
PI: ok then just one.  
ATC: ok, let me show you because I don't know what it is called  
PI: this is the SAC  
ATC: ok, yea I wasn't sure.  
that's how we also follow up on them.  
To determine right then and there or to determine like back to practice?  
Well, its how you decide them to return to play  
Well, it they are asymptomatic 10 15 minutes later then they are allowed to go back to the game, but I will put both  
Ok, here, what is the name, it is the one in Arlington but I cant remember the name.  
PI: SCATA or NATA

ATC: well that's here, not the arlington one.  
PI: then you can put that under there, and right there.  
ATC: How do you manage and follow up, what do you mean?  
PI: So you told me that you use the SAC re-eval, you do it everyday, or how, when?  
ATC: Well we do it the day after, and then we will do it, a couple of times, until we start eliminating symptoms and they're 'normal'  
Ok, here we do like a progression, we have them on the bike, or do some jogging and see how they feel, if we held them out for a day or 2 even a week, we have them do a little bit of the bike then run and not just throw them back in to practice or a game

### 3.3.1

ATC: My question is gonna be can I pull it out of the back of my head!  
PI: haha  
ATC: Date of graduation, a long time ago  
That's as good as its gonna get, unless you want me to break it down into cognitive, motor, etc?  
PI: Its up to you, if that is your definition then that is what I want.  
ATC: Ok.. Lets see.. I am happy to say that it was only 1 this year  
PI: nice  
ATC: this is just in general - not that one kid  
PI: yes in general  
ATC: oh, god, 20 years, every one of these symptoms - It can be all of them to be honest with you.  
I don't use any of these, it is a combination of everything and it is experience, we have seen it all and we read it all. Especially because everyone is different and symptoms are seen with some and not all or visa versa.  
PI: Ok, put that under other  
ATC: In all honesty we don't return them to play  
PI: well, ever? For the whole season?  
ATC: Oh, I got it, you mean after.. Yea I got it.  
heck no the coach doesn't!  
Question number sixteen, I'm trying to think if, I don't think we ever had a kid with multiple concussions..  
PI: well is there a standard number you go by? I been hearing there is a standard according to UIL or even if it depends on the severity.

ATC: 3 is too many if you want my personal opinion, in all honesty every thing is based off medical clearance and then we take it from there, we evaluate them everyday and make sure they are asymptomatic, this this and this ya know

It doesn't matter what time or instant?

PI: no

ATC: I'm sure everyone has given you SCATA

PI yes, but is there anything else you may do or look at or attend or receive?

#### 4.2.1

ATC: Oh, really, I have to give you the date of my graduation?

PI: Yes mam, I am looking at years of experience with that question.

ATC: my english teacher would roll over in her grave, using the word define to define

PI: On those questions, would I have to interview your other trainer or will they be the same?

ATC: No, I was here all season, she is new so I am including the total for the season.

Oh god, total number of players.

PI: Ok, how many there?

ATC: well see the varsity games are all on artificial, and well fresh and jv - when we play at the sac it is turf , so here 3 and 4

PI: ok. So of the five, and 3 varisty games

ATC: lets see. 2 in varsity games and the rest

PI: the rest would be 5 on natural.

ATC: yea that would be right.

Oh, we made all the kids and coaches watch the ESPN video.

PI: Yes, that's a good video

ATC: total number of football players, we had five football teams, 40, that's close to .. The total is about 200.. So 60...

ATC: here you are referring to double vision? Or talking about pupil reaction

PI: anything having to do with visual, so they would both fall in there

ATC: Asymptomatic for a complete week, so if they are ok, ok, headache, NO, time starts over again, until it is one complete week then we allow them back to play.

Oh shoot, other, dr. clearance, dr. says its ok.. But I still try to keep an eye, they get a headache (snap finger)

Pretty much check in with me on a daily basis. How you doing, you have any headaches, typical things..

Oh, all of these, not the scholarship but pretty much.. Be a "tough guy" ..

PI: Oh, I know..

## **Curriculum Vita**

Princess A. Puga has found a new passion in research and learning about the sciences and is pleased to be culminating her master's in speech language pathology with this thesis. Princess was born in El Paso and raised both in El Paso and Mexico. After graduating from high school in three years with honors and top of her class, at seventeen Princess joined the United States Air Force, which exposed and taught her various aspects of life and different cultures from all her fellow airmen. This experience shaped Princess's dedication, diligence and perseverance to work and study simultaneously to attain a degree in four and a half years. Princess expects to return to life as a student in pursuing a doctorate degree in speech language pathology in the near future.

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