

FACTORS AFFECTING CONCUSSION SYMPTOM
SELF-REPORTING AMONG DIVISION I
COLLEGIATE CHEERLEADERS

By

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CHAPTER I

INTRODUCTION

There is a continuing debate as to whether cheerleading is a sport or not. Many people think of cheerleaders as simply the individuals shouting and leading chants on the sidelines at sports events. Cheerleading activities have changed and expanded over the last few decades.¹ An increase in the popularity and participation in cheerleading has resulted.² As participation has increased so have the difficulties of the stunts, pyramids, and tumbling skills being performed.² The athleticism required for cheerleading is difficult to overlook, specifically in the execution of elite, competition-level skills. While it fosters recognition and strength to the argument for cheerleading to be considered a sport, increases in difficulty and competitiveness lead to increased risks of injury for its participants.

Cheerleading is considered to be an activity with a high-risk for injuries despite upgrades in safety rules and limitations over recent years.³ A low rate of injury overall has been observed in cheerleading, though the risk for catastrophic injury is high.²⁻³ Injuries to the head and neck have obvious serious consequences and are arguably the most perilous injuries to which the participants are exposed during cheerleading participation. Most injuries that affect the spinal cord are hard to mistake. Spectators can recognize a serious injury has occurred when they see a motionless athlete lying on a

playing field. Even medical professionals are challenged by evaluations of closed-head injuries.⁴⁻⁸ Signs and symptoms of head injuries manifest themselves in various manners and intensities. Concussions in particular pose a challenge because of the varying degrees of severity, specific symptoms, symptom resolution time, and individuals' concussion history.⁹⁻¹⁰ The mechanism of injury for a concussion is not necessarily always as obvious or as traumatic in appearance as an individual being dropped on the head or receiving a direct helmet-to-helmet blow. Many cheerleading skills afford the opportunity to sustain a concussion during their execution.³ The term "concussion" has also become much more of a colloquialism, used frequently as a catchall by commentators or individuals unqualified to diagnose a concussion.^{5,11} Issues such as these make concussion in sport a particularly poignant health topic, especially as stories continue to appear in the media of athletes, new and old, suffering from previous head injuries.

Concussion signs and symptoms have been documented for many years, though some elements of the complex nature of concussions are still not fully understood.^{5,12} It can be challenging to objectively evaluate for a concussion and even more challenging to establish when it is safe for an athlete to return to play.^{10,13} It is widely accepted that suffering a second concussive-force before a previous concussion has fully resolved is dangerous and can lead to second impact syndrome.^{5,9,14-17} There is also increasing support that there are long-term, detrimental effects of suffering multiple concussions over time.^{6,18-22} A concussed athlete will generally experience a successful return to play but it is vital that a concussion injury be treated as a serious injury in order for that to happen.⁴ Caution and patience during injury recovery and return to participation are

imperative in order to maintain personal safety and health especially for an individual participating in higher-risk, contact sports.⁵ A graduated return to play protocol is recommended and an athlete should not be progressed unless symptom-free in each stage.²³

Cheerleading is of particular interest when discussing concussions. Cheerleading is a total-body activity and, when compared to other sports, it is much more likely that one or more additional teammates are at some increased risk of harm if an individual continues to cheer while injured or concussed.³ Cheerleading skills such as group or partner stunts, basket tosses, and pyramids all involve multiple people; some of those individuals are potentially as high as 20 feet above the ground.² Even individual tumbling skills and skills executed on the ground can require precise movements and timing. Each cheerleader must properly execute their skills to ensure their safety as well as that of other surrounding teammates who may be performing a different skill. This is particularly important when placed in the context of a performance routine. If a cheerleader suffers a concussive-force yet continues to cheer, the risk level for everyone participating increases.¹⁶ It might seem logical that an individual experiencing concussion symptoms would not continue to participate, however, this is not necessarily the case. Symptoms often go unaddressed because they are not mentioned by the individual or recognized by someone else.¹⁸ Athletes in particular are unique in that they are often motivated to continue participation regardless of symptoms they may be experiencing.⁵

There have been numerous proposed reasons why concussion symptoms go unreported by individuals.^{5,10} Research investigating the reasons cheerleaders fail to

report symptoms they experience is essentially nonexistent. The issue of non-reporting is compounded by the potential for one or more factors to influence an individual's symptom self-reporting, and those factors vary from person to person. These influencing factors can be psychological, sociological, environmental, or knowledge-based.^{7,10,12,16,24-27}

National Collegiate Athletic Association (NCAA) Division I school cheerleaders may experience unique pressures and factors that affect the reporting of concussion symptoms. Pressures to continue participation despite injury can be self-imposed or come from teammates, coaches, families, or even fans.^{16,27} Psychological factors such as fear of letting teammates down, being perceived as weak, and being removed from participation are all reasons proposed to affect symptom reporting.^{12,27} These external pressures may not actually even exist in many situations. The individuals perceive that they exist and, therefore, allow them to influence their health behaviors and injury reporting.²⁸ Health behavior theory is useful to help understand the possible sources and interactions of these factors.²⁸ The accessibility of medical care and supervision may also influence symptom reporting and concussion diagnoses of collegiate cheerleaders.¹⁰ There is currently no set standard of care and there are variations regarding how each school provides and cares for its cheerleaders, primarily because cheerleading is not an NCAA-recognized or regulated sport.¹

The ideal scenario is for athletes to have good knowledge of when an injury has occurred and for universities to have health care providers to whom athletes can report symptoms and injuries.¹⁰ It is also critical to have coaches who prioritize athletes' health and athletes who possess an appreciation for their own personal health and that of their

teammates.^{9,29} Every cheerleading program's situation is not ideal though. Injury reporting will also vary by the type and level of sport participation and may be influenced by the time in the season when the injury occurs.^{5,25} The presence of certified athletic trainers and medical personnel available on site can help facilitate a good rapport with the athletes, encourage communication about injuries, and guide safe participation for everyone involved.^{9,23}

It can be a challenge to convince athletes that they need to treat concussions as they would any other sprain, strain, wound, or fracture injury.⁵ A certain period of healing needs to occur before a return to participation is healthy.³⁰ Certain pathological aspects and effects of concussions are elusive.¹⁰ Education about mechanisms of injury, symptoms, effects, and health risks is critical for all ages and levels of participation to help protect individuals potentially exposed to concussion in sport.^{9,29} It is critical for all participants, coaches, health care providers, schools, parents, and friends to be knowledgeable about head injuries.^{9,29,31} All parties must play an active role in making sure all athletes who display signs and symptoms of concussion are referred to medical personnel for thorough evaluation and are not allowed to return to participation until fully asymptomatic.^{1,9} Everyone's ultimate goal should be optimal health and safety of all individuals participating. Rates of concussion symptom self-reporting can be improved by identifying the factors that affect symptom reporting among collegiate NCAA Division I cheerleaders. The information garnered from this study can also provide valuable information for educating and creating interventions unique for this at-risk population.

Purpose of the Study

The purpose of this study is to investigate the psychological, sociological, and environmental reasons that contribute to collegiate cheerleaders' failure to self-report concussion symptoms. The aim is to identify if individuals with symptoms of a concussion simply choose consciously to disregard their symptoms, if they feel pressured to continue by teammates and coaches, or if the problem of underreporting stems from another source, such as a lack of knowledge regarding symptoms or health risks. This study also investigates whether rates of reporting and concussion diagnoses change by having informed and educated individuals, such as a certified athletic trainers or certified coaches, present during participation in cheerleading activities. Identifying the factors that influence concussion symptom reporting will provide valuable avenues for education and intervention development and implementation in cheerleading in order to decrease health risks and improve outcomes.

Need for Study

Cheerleading is unique because almost all universities and colleges have some type of cheerleading program even though cheerleading is not recognized as a NCAA sport. Subsequently, little research has been done with this population. Concussions in sport are a particularly salient health concern for the NCAA and athletic world in general. Cheerleading certainly has a place in the dilemma, though it is often overlooked due to the popularity of other sports and other levels of play (e.g., youth sports or professional sports). Research investigating the health behaviors and motivations of athletes is critical. The knowledge gained could be used to help improve injury prevention

initiatives, athlete education, athlete self-reporting, and onsite treatment of concussion injuries by athletic trainers and healthcare providers.

Hypotheses

1. Cheerleaders in the NCAA Big 12 Conference will be less likely to self-report concussion symptoms they experienced compared to high school football players.
2. Concussion symptoms will most frequently be self-reported by the NCAA Big 12 cheerleaders to athletic trainers.
3. Not wanting to be held out of participation will most frequently be reported as the reason NCAA Big 12 cheerleaders did not self-report the concussion symptoms they experience.
4. There will be no statistically significant difference in the incidence of concussions between female and male NCAA Big 12 cheerleaders.
5. Male NCAA Big 12 cheerleaders will be less likely than females to report concussion and injury symptoms at the time of injury.
6. NCAA Big 12 cheerleaders will agree with statements that perceived social pressures influence injury self-reporting.

Delimitations

1. The study will be delimited to cheerleaders who are members of NCAA Big 12 Conference universities' sanctioned cheerleading programs in which cheerleaders perform stunts and tumble.

Limitations

The following limitations were recognized during the course of this study:

1. Participants are recalling previously experienced symptoms over an elapsed period of time.
2. Participants are self-reporting on previously experienced symptoms.
3. There are different skill levels among members of each squad.
4. There are varied risks present for a co-ed squad member versus an all-girl squad member.
5. There is not a safeguard against multiple questionnaire submissions by any one individual.

Assumptions

The following assumptions were made during the course of the study:

1. All subjects completed the questionnaires accurately and honestly even when potentially admitting health-compromising behaviors.
2. The cheerleaders were knowledgeable about cheerleading and participating.
3. The cheerleaders understand the terminology for the specific signs and symptoms of concussions that is supplied to them in the questionnaires.

Definition of Terms

1. **Base** – “A person who is in direct contact with the performing surface and is supporting another person’s weight.”³²

2. **Basket toss** – A skill in which “a cheerleader is thrown into the air by either three or four throwers.”² The cheerleader may perform a series of flips and/or twists in the air before being caught by the throwers.
3. **Catastrophic injury** – “A sport injury that resulted in a brain or spinal cord injury or skull or spinal fracture.” Catastrophic injuries are also subdivided into fatal, nonfatal, and serious categories. A serious injury is a severe injury that does not result in permanent disability.¹
4. **Chronic traumatic encephalopathy** – A neurodegenerative disease of the brain tissue that occurs due to repeated traumatic forces to the head and brain. Chronic traumatic encephalopathy (CTE) is characterized by deposition of toxic tau proteins into brain tissue, resulting in symptoms of memory and cognition loss, behavioral changes, and dementia.^{19,33}
5. **Closed-head injury** – A term used to describe an injury to the brain that does not involve a direct injury to the skull.
6. **Concussion** – “A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.”^{23,34}
7. **Health behavior theory** – The application of theoretical constructs and models to help explain why individuals participate or fail to participate in certain health behaviors and to help design interventions.²⁸
8. **Mechanism of injury** – The source or cause of an injury.
9. **Neuropsychological testing** – Testing used to “evaluate various cognitive domains known to be preferentially susceptible to the effects of concussion and traumatic brain injury.”⁹

- 10. Pyramid** – “A skill in which a top person is supported by a middle layer person.”³²
- 11. Second impact syndrome** – A rapid neurological and physiological deterioration associated with suffering a second concussive impact before previous concussion symptoms have fully resolved.^{8,10,15}
- 12. Spotter** – An individual designated to catch or aid the base or bases in catching a top person in the event of either a failed stunt or a dismount.³²
- 13. Stunt** – “A skill in which a top person is supported by a base or bases.”³²
- a. Group stunt** – A stunt which utilizes typically two or three bases to support a top person.³²
 - b. Partner stunt** – A stunt that consists of one base supporting a top person.³² Typically a male base with a female top person.
- 14. Top/Flyer** – “A person who is either being supported by another while off of the performing surface or who has been tossed into the air by another person.”³²
- 15. Toss** – “A movement by one or a group of participants that propels a person into the air so that the person is airborne.”³²
- 16. Tumbling** – Skills that involve flipping the body and may incorporate twisting movements.
- a. Standing tumbling** – A tumbling skill executed beginning from a stationary position.
 - b. Running tumbling** – A tumbling skill or series of skills that is executed after a running start.

CHAPTER II

LITERATURE REVIEW

The majority of research and data collection to date on concussions in sport has involved football, rugby, soccer, hockey, and wrestling athletes.^{5-6,10,13,22,26,35-36} Many researchers have acknowledged possible reasons for underreporting symptoms, though few have aimed directly at trying to identify those reasons.^{7,10} This may be largely attributed to the fact that much research has been directed toward gathering more fundamental information about concussions, such as symptom presentations, etiologies, and short- and long-term effects; much is still unknown or not fully understood. Existing literature regarding cheerleading has looked at the issue of catastrophic injuries during participation, but has not specifically addressed the prevalence of concussion and the heightened risks when participating while concussed.¹⁻² Health behavior theory can be used to aid in identification of symptom underreporting causes. The following review of literature covers a multi-faceted range of topics that contribute to a thorough investigation of concussion symptom reporting among collegiate cheerleaders.

Concussion

Pathological Aspects of Concussion

Acutely, concussive forces cause decreases in neuromuscular control and coordination and changes in neurocognitive processing.^{5,9} These changes can result from altered or ineffective neurological signals from the vestibular, visual, and somatosensory systems, though the exact pathologies associated with concussion are not fully known, particularly for mild injuries.^{13,17,30} Common signs of concussion include amnesia, difficulty balancing, lack of motor coordination, disorientation, vomiting, and inappropriate emotional responses.^{5,9,11} Increased postural sway has been observed in athletes^{17,30,37} and can potentially make cheerleading participation while concussed much more dangerous. Symptoms commonly experienced include headaches, dizziness, sleep disturbances, fatigue, and difficulty concentrating.^{5,11} The variation in symptom presentation is most likely attributable to the type of biomechanical force which created the concussion.^{5,16} If any concussion symptom is present then the athlete should be removed from play and thoroughly evaluated for a concussion.²³

Several different scales are used to gauge and convey concussion severity, often using loss of consciousness and amnesia as distinguishing criteria (e.g., American Academy of Neurology Concussion Grading, Colorado Medical Society Grading, and Cantu Evidence-Based Grading System for Concussion).⁵ These scales can be useful but are not proven predictors of neurocognitive and neuromuscular disability.^{9,30} Too much emphasis on loss of consciousness and amnesia is the main criticism of the grading scales.^{4-5,30} Evidence-based research to support the grading scales is lacking. Brief loss of consciousness and amnesia are not proven predictors of neurocognitive decline, lack of

motor control, or long-term disability.^{5,23,30,37} Concussion severity is often only determinable in retrospect, once an individual is completely asymptomatic.¹²

Second Impact Syndrome

Second impact syndrome is rare, but is one of the biggest concerns and risks associated with concussion injuries. Second impact syndrome occurs when a second concussive force is suffered before a previous concussion has fully resolved.^{8,10,15} It is associated with a rapid neurological and physiological deterioration and is extremely debilitating and often fatal.¹⁵ Second impact syndrome is more commonly seen in adolescent athletic populations, though there is a risk at any level.^{4,9,15} McCrea et al¹⁰ stated that most second impact syndrome cases are a result of athletes failing to report injuries or from poorly managed injuries. Poor reporting and treatment further illustrate the need for athletes' knowledge of symptoms and honest injury reporting.

Once an individual suffers an initial concussion he or she is more susceptible to suffer another concussion.²² NCAA football players with a history of three or more concussions were found to be at three-times-greater risk to experience future concussions than athletes without a history of concussion.^{6,22} It also takes less force to suffer a second concussion once an individual suffers an initial concussion, even in the absence of a premature return-to-play.¹²

Repeat Concussions

Post-concussive changes and symptoms are generally transient.¹¹ There can be irreparable injury depending on the severity of injury though.⁴ It is possible for effects

from several smaller forces to compound, resulting in potential permanent damage or increased risk for second impact syndrome.^{5,17} Boxing has been acknowledged to pose neurological risks, though those risks did not directly parallel other sports.⁸ However, newer research has found evidence of chronic traumatic encephalopathy (CTE) in retired football players who each suffered many repeat concussions.¹⁹⁻²¹ CTE is a type of progressive brain damage involving neurofibrillary tangles in neurons and glial cells, resulting from repeated trauma to the head.^{19,33} The tau protein deposits, an indication of CTE, found during autopsies are similar to ones seen in late-life individuals with cognitive impairments and dementia-related diseases.¹⁹ The toxic tau proteins impair normal brain functioning and ultimately kill neurons.³³ The clinical symptoms of CTE include memory impairment, erratic behavior, emotional instability, depression, and dementia.¹⁹ A correlation between recurrent concussion history and “increased lifetime burden” due to memory impairment, mild cognitive impairment, and Alzheimer’s disease has also been observed.²¹ Repeated trauma to the brain can result in serious long-term effects on the brain, especially if injuries are not allowed to fully heal.¹⁹ In addition, retired NFL players with a history of three or more concussions were found to be three times more likely to be diagnosed with clinical depression later in life.²⁰ These findings suggest that boxers are not the only athletes at risk for neurodegenerative impairment and disease later in life due to recurrent sport-related concussions and head trauma. Over 100 other athletes, including professional football and hockey players, have already pledged to posthumously donate their brains to be studied for CTE.³³ Though no definitive correlation has been established to date, “clinicians need to be mindful of the potential for long-term problems,” such as CTE, associated with recurrent concussions.²³

Resolution Time

Concussion symptoms are challenging to accurately evaluate and measure. It is widely accepted that a multi-modal approach is essential to ensuring that an athlete is ready to return to participation post-concussion.^{5,9,12,34} Symptoms present differently in each individual and similarly they resolve at different rates.³⁸ Individuals with a history of concussion require longer periods of time for symptoms to resolve than those without previous concussions.¹⁸ Post-concussion differences in symptoms and neurocognitive function between male and female athletes have also been observed.^{35,39} Men experienced greater symptom frequency and severity acutely but women experienced greater neurocognitive deficits in visual memory, though the basis for those findings remained unclear.³⁹ Similarly, men were observed to have a greater number of concussions in the previous year than females, though they had faster return to competition than females.³⁵ More research is still needed in order to establish conclusive evidence on the relationship between sex differences and concussions, however.²³

Studies continue to emphasize that it is not enough to rely solely on an athlete's symptom report, even if the individual is being entirely honest.^{7,30} One study found that 38% of the athletes tested continued to show "impaired test performance relative to their baseline evaluation despite denying the presence of concussion-related symptoms."⁴⁰ Evidence of memory deficits have been found to persist at least seven days after even "mild" concussions in a high school population.¹³ An individual's perceived stress has been found to have an effect on symptom severity as well.⁴¹ It is not hard for an athlete to return to participation before being fully asymptomatic, even without additional motivation to curtail reporting symptoms.⁷

Cheerleading Injury Rates

The NCAA does not include cheerleading under its injury surveillance survey, and as a result, few reports on cheerleading injury rates are available.²⁻³ The majority of injury data comes from hospital emergency department reports.¹ The National Center for Catastrophic Sports Injury Research (NCCSIR) has published much of the information available. The NCCSIR's Twenty-First Annual Report stated that cheerleading-related catastrophic injuries have increased over the past 25 years, but acknowledged that participation has increased as well.¹ The number of catastrophic injuries was higher for high school than collegiate participants.¹ Collegiate cheerleading accounted for a higher rate of direct catastrophic injuries.¹ Cheerleading accounted for 56.3% of combined high school and collegiate direct catastrophic injuries¹ and over 59% of female collegiate direct catastrophic injuries¹ between 1982 and 2007. This data did not include concussion injuries unless severe brain injuries with further complications were present. The NCCSIR partnered with the National Cheer Safety Foundation in 2008 in an effort to improve the collection of cheerleading injury data throughout the country. Cheerleading then accounted for over 66% of all collegiate catastrophic injuries.¹

Prevention and Management

The brain cannot be “conditioned” to withstand injury so “extrinsic mechanisms of injury prevention must be sought.”³⁴ Public attention regarding sport-related concussions has led to the development of new rules guiding participation and initiatives for education, key components to reducing concussions.^{12,23} The NCAA and Varsity Brands formed the College Cheerleading Safety Initiative in 2006 in an effort to improve

cheerleading safety.¹ Regulating the number of flips and twists in cheerleading allowed, as well as requiring spotters during activity are examples of rules aimed at reducing the rate and severity of concussions and head injuries.^{2,12,32} The AACCA Cheerleading Safety Manual provides updated safety rules and guidelines for all college coaches.^{1,32}

The use and accessibility of athletic trainers is frequently mentioned in literature as one of the best methods of injury prevention and detection.^{1,7,9,12,29} The National Center for Catastrophic Sport Injury Research has recommended several steps toward injury prevention including having a certified athletic trainer at each school and a written emergency action plan.¹ The National Athletic Trainers' Association has also issued recommendations for concussion management, including that when an athlete experiences or shows any signs of head trauma the individual should receive immediate medical attention prior to returning to participation.^{1,9,23} Certified athletic trainers should be highly active in "educating athletes, coaches, and parents about the signs and symptoms associated with concussion, as well as the potential risks of playing while still symptomatic."⁹ Athletes participating in sports with a high-risk for concussions should also utilize baseline cognitive and postural-stability testing, if possible.⁹ Coaches should be also educated that if an injury occurs and a certified athletic trainer is not available, their role is to ensure that medical personnel see the athlete immediately.⁹ Onsite athletic trainers and informed coaches can help manage medical costs by ensuring swift and proper treatment.¹ The NCAA's insurance program reported 25% of the money spent on athletic injuries in 2005 resulted from cheerleading.¹

The other most commonly recommended avenue for prevention is athlete education. Giving athletes the knowledge they need to recognize, understand, and avoid

concussions will ultimately be more effective at decreasing the occurrences of concussion and athletes continuing to participate while concussed.^{1,7,9-10,12,29,34} The NCCSIR specifically recommends that coaches should encourage athletes to inform them of any concussive symptoms and why it is important to do so.¹ Athletes need to understand that the ramifications of a concussion injury are serious and that there is an increased risk for injury to themselves and others if they continue to participate while concussed.¹⁶ Education and awareness about concussion detection, signs and symptoms, second impact syndrome, increased risk for subsequent concussions, and potential cumulative effects of concussion must be conveyed to athletes, coaches, referees, parents and health care providers.²³

Currently no good clinical evidence exists for the effectiveness of protective equipment at preventing concussions.²³ Mouthguards have been found to be important in preventing oro-facial and dental injuries and headgear and helmets can reduce biomechanical forces to the brain, though neither has been shown to reduce concussion incidence.²⁹ Softening playing surfaces are also frequently cited as an area for injury prevention though softer playing surfaces have only been found to do more to protect from musculoskeletal injuries instead of head trauma.⁵ Rules and regulations regarding the specific cheerleading skills that can be performed on certain surfaces (i.e., court, grass/turf, and mats) are the most common type of prevention methods utilized for cheerleading.²⁻³ The use of mats are recommended and required for the execution of certain skills, though it is unclear how effective those ultimately are at reducing severe injuries.²

Concussion Symptom Reporting

Symptom Self-Reporting

Health care providers rely largely on self-reports from individuals as the information source regarding the individuals' ailments and as a basis for establishing severity.^{26,42} Previous post-concussion return-to-play guidelines have been largely dependent on self-reported symptoms.²⁶ The most common weakness with self-reporting "relates to the honesty and motivation of the respondent."³⁶ The use of self-reported symptoms is also largely affected by the patient's knowledge about the symptoms.^{7,10,43} Self-reports are a good representation of symptoms relatively soon post-injury; however, accuracy diminishes the longer it has been since injury.³⁸ A graded symptom checklist (GSC) is a self-report scale commonly used for measuring concussion symptoms.⁴⁴ A GSC contains a list of usually 16-25 symptoms and respondents are asked to rate the severity of each symptom on a seven-point Likert-type scale.⁴⁴ The list of symptoms includes, but is not exclusive to, headache, nausea, dizziness, vomiting, balance problems, numbness or tingling, blurred vision, sleeping more than usual, drowsiness, fatigue, sadness, trouble falling asleep, feeling "slowed down," feeling "in a fog," difficulty concentrating, and difficulty remembering.⁴⁴ Self-symptom reporting is valuable, inexpensive, and applicable to all clinical settings, but cannot be the only method of evaluation utilized to establish a safe return-to-play.^{9,17,40,45} Neuromuscular and neurocognitive impairments persist even after symptoms have resolved and returned to baseline.^{38,40} It is insufficient by itself and should be used in conjunction with other cognitive, psychological, and neuromuscular concussion assessment tools.^{5,9,26,40,45} It is recommended that a thorough baseline concussion evaluation (including self-reported

symptomology, a physical examination, balance testing, and neurocognitive testing) be completed in order to provide a more reliable, objective comparison if needed post-injury.^{9,40-41,45}

Athletes are unique in that they are the only patient group that desire to return to activity despite the presence of a current injury.⁵ Their intrinsic motivation to continue participation can influence their self-symptom reporting of concussions, orthopedic injuries, and illnesses.^{5,7} Self-report is a valuable tool for concussion assessment; however, within an athletic population it is important to keep in mind athletes may potentially modify their reported symptoms unconsciously or in an effort to expedite a return-to-play.

Proposed Causes for Deficient Reporting

Multiple reasons have been suggested as to why concussions are not always reported. Not wanting to be withheld from participation and a lack of knowledge or awareness about concussions are two of the most common reasons proposed.^{5,10} A study by McCrea et al¹⁰ is one of the few designed principally to investigate the frequency of unreported concussion symptoms and more accurately estimate the overall rate of concussion among high school football players. Their findings showed 15.3% of the football players reported they had sustained a concussion during the current season, and of those, 47.3% of the players reported the concussion, most commonly to an athletic trainer.¹⁰ Of the individuals who did not report their concussion 66.4% did not think the injury was serious enough for medical attention, 41% did not want to be withheld from play, and 36.1% were unaware they had a probable concussion.¹⁰ Similar reasons for not

reporting concussion symptoms were observed in a collegiate population. A lack of knowledge about head injury consequences was observed in over 56% of the athletes in a study at the University of Akron.⁷

Other reasons have been proposed to affect the reporting of concussion symptoms.^{5,25,27} Feeling pressured to continue participating by coaches, teammates, fans, media, parents, or one's self can play a part in why injured individuals continue to participate.^{5,27} In addition, male athletes especially reported "external pressures and threats to masculine identity" as reasons to risk further injury.²⁷ Players who try to continue participation despite symptoms of head injury out of well-intended devotion to the team may actually be doing the team a disservice or placing teammates at an increased risk for injury.⁵

Environmental factors influence decisions to engage in health-damaging behaviors and should not be underestimated.²⁵ Even financial situations can affect symptom self-reporting if the individual is stressed to return to participation to get paid, or hopes to one day be drafted.^{5,43} The competitive context of athletics itself can even undermine the welfare of athletes by reinforcing risky health behaviors like continuing participation when injured.⁷

Athlete mentality plays a role in injury reporting. Athletes who have high self-efficacy are more likely to engage in more calculated sport risks.⁴⁶ A low perception of injury risk and lack of personal susceptibility contribute to a discord between the athlete's mental perception of injury and motivation to report the injury.⁴⁶ Athletes are aware that injuries are an inherent part of athletic participation and, therefore, may underreport potentially serious injuries.^{7,27} Athletes are also often taught that they should "play

through the pain” and need to present a “tough” image.⁷ One’s desired self-presentation, the image that he or she wishes to put on display for others, can affect self-reporting.²⁵ Self-presentation may not be as significant of a factor in an athletic population.²⁵ Cheerleaders, however, may be more motivated to underreport symptoms due to concerns about self-presentation because they are typically a more image-conscious athletic population. Future directions for research include “identifying factors that cause people to highly value the impressions associated with the performance of risky behaviors” and designing interventions that “play upon people’s self-presentational concerns.”²⁵

Theory Application

Health behavior theory utilizes constructs and models to help explain why individuals engage in certain health behavior choices and to identify why a health problem exists.²⁸ Health behavior theory is used by health educators and health professionals to create interventions that address and aim to improve negative health behaviors.²⁸ Health behavior theories can be tailored for application to a variety of health issues and populations. Theories are often geared towards “reducing obstacles to change and promoting informed decision making” for individuals and communities.²⁸ One example is that individuals experiencing symptoms of a heart attack have been found to dismiss or ignore symptoms, thereby delaying treatment.²⁴ Interventions can be developed to address the components of a health issues such as that by stressing the importance of not downplaying symptoms or feeling like a burden to others if complaining of symptoms.²⁸ Interventions are most effective when they address “multiple levels of influence,” such as “individual, interpersonal, institutional,

community, and policy levels.”²⁴ Health behavior theory certainly is applicable to addressing the issue of underreported concussion symptoms in a collegiate, athletic population.

The Health Belief Model (HBM) is widely used in health behavior research and to develop effective interventions.²⁸ Social psychologists for the U. S. Public Health Service originally developed the HBM in the 1950s in an effort to address a widespread lack of participation in health screenings. The constructs of the HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.^{28,47-48} The HBM possesses the valuable quality of accounting for individuals’ perceptions of factors, such as benefits and barriers, which affect the likelihood that an individual will engage in a preventative health action.⁴⁷ Generally, a person’s perceived benefits and perceived self-efficacy must outweigh the perceived barriers in order for action to occur.^{28,47} Additional modifying factors such as age, socioeconomic status, and sex also influence an individual’s beliefs about a health issue and affect his or her behavior.^{28,47} Examples of the application of the HBM include gauging osteoporosis prevention in college women,⁴⁹ mothers’ adherence to their childrens’ asthma regimens,⁵⁰ and athletes’ performance enhancing drug use.⁵¹

Getting cheerleaders to personally recognize their susceptibility to concussions, the severity of participating concussed, the benefits of allowing healing, and their ability to overcome barriers is critical. Perceived barriers have been identified as the greatest predictor of health behaviors.²⁸ Benefits must outweigh the costs and barriers in order to engage in the healthy behavior.⁴⁷ Therefore, interventions addressing the barriers that

collegiate cheerleaders may perceive, such as being withheld from participation and lack of medical care accessibility, can improve concussion injury reporting.

Protection Motivation Theory (PMT), another pertinent health behavior theory, involves cognitive appraisal processes to explain an individual's health related decision-making processes, especially as it appeals to the individual's sense of fear.^{48,52} The two major components of the PMT are threat appraisal and coping appraisal.^{48,52} The two components are processes that attempt to match the cognitive processes people use in evaluating threats and selecting coping alternatives.⁵³ Perceived severity, perceived susceptibility, perceived likelihood that engaging in a health action will reduce a health threat, and self-efficacy are factors incorporated in PMT.^{52,54} The appraisal of threat motivates an individual to engage in either an adaptive health behavior or a maladaptive behavior.⁵² The target adaptive or protective behavior in the present study is reporting concussion symptoms experienced.

Threat appraisal, mainly comprised of perceived susceptibility and severity, is often evaluated within the context of the PMT as the 'protection motivation' component.⁵² A threat must be perceived before there can be an evaluation of coping appraisal.⁵³ It is unclear whether threat appraisal is processed in the same way for athletes due to the social network structure that they participate in, however.⁵² Coping appraisal is closely tied to self-efficacy and, especially for athletes, the perceived treatment efficacy is a key determinant of injury rehabilitation compliance.^{52,55-56} Protection Motivation Theory has been used to analyze health-related advertising message themes such as with antismoking campaigns⁵⁴ and also with efforts against performance enhancing drug usage by athletes.⁵¹

Both the HBM and the PMT stress an individual's "subjective interpretation of reality."⁴⁸ Ultimately both the HBM and PMT can be utilized to target individuals' attitudinal and behavioral intentions towards engaging in health-promoting, adaptive behaviors.⁴⁸ There are both prevention and response components involved with improving the healthy, protective behavior of concussion symptom reporting. Promoting knowledge about vulnerability, self-efficacy, and positive outcomes of adaptive health behaviors is an avenue for application of the PMT and the HBM in a collegiate cheerleading population to improve the reporting of concussion symptoms.^{48,53}

Summary

A system that relies on athletes' self-reporting of concussion symptoms is innately flawed. Other objective means of evaluating concussion resolution and return-to-play criteria are essential. The athlete must first report that he or she is experiencing concussion symptoms before an evaluation process can even occur. Each sport has unique stressors and contributing factors, and cheerleading is no different. Health behavior theory is applicable to the problem and can be utilized to help identify and target psychological, social, environmental, and knowledge-based factors that affect symptom reporting. Nevertheless, equivalent research, medical care, and injury surveillance data collection are severely lacking for the collegiate cheerleading population in comparison to that of sports recognized by the NCAA.

CHAPTER III

METHODS

Research in the area of cheerleading is minimal primarily because it is not recognized as an NCAA sport. Statistics and data on injuries and safety initiatives are lacking for the same reasons.² Cheerleading is considered a high-risk sport and almost every skill has some potential for a head injury to one or more teammates.² A concern that arises is when an athlete suffers a closed-head injury or concussion and continues to participate. An athlete who displays some of the objective signs of a concussion may be less challenging to recognize, though the athlete who is experiencing the subjective symptoms of concussion is not as easy to identify.¹⁰ A concussed athlete who continues to participate increases personal risk, as well as the risk of other team members.⁵ Previous research among other sports has shown that concussion symptoms are frequently underreported, which is a troubling trend.^{7,10} Research is clearly needed that aims to identify why athletes, particularly cheerleaders, continue to participate despite experiencing concussion symptoms.

The purpose of this research is to identify the reasons and factors that affect whether cheerleaders do or do not report concussions symptoms. Questionnaires were used to identify perceived psychological, social, and environmental barriers and facilitators to reporting concussion symptoms in order to increase concussion reporting

and reduce risk of further injury due to unreported symptoms and injury. The subjects, questionnaires, and procedures are described within this chapter.

Subjects and Recruitment

The population for this study was members of collegiate cheerleading teams officially recognized by the schools in the NCAA Division I Big 12 Conference. These subjects were chosen in order to provide a random assortment of cheerleading program skill levels, attempting to reflect the skills present among the NCAA Division I collegiate cheerleading population as a whole. Two of the 12 schools were initially excluded; one does not have cheerleaders and the other's cheerleading program does not stunt or tumble. The researcher contacted the remaining Big 12 cheerleading coaches and athletic trainers via e-mail to inform them about the research and to request their teams' rosters and e-mail addresses (see Appendix 1). Four universities' coaches or athletic trainers agreed to participate, one declined to participate, one was still seeking approval to participate when data collection ended, and four universities provided no correspondence. The individual subjects were then contacted by e-mail, asking for their voluntary participation in the study (see Appendix 2). The survey was set up using Microsoft FrontPage software and hosted on Oklahoma State University's server (see Appendix 6). Subjects acknowledged their informed consent by clicking on the questionnaire Web site link as approved by the Oklahoma State University Institutional Review Board. Subjects were offered the chance to enter their e-mail address in to a drawing to win one of four \$25.00 iTunes gift cards if they completed the survey by a specified date.

A total of 168 e-mails were sent out to the cheerleaders at the four schools. Forty-two data entries were received in return. Two of the submissions were removed for data analysis due to large amounts of incomplete data. The study procedures were explained in the e-mail, and included a link to the study Web site.

Selection of Instruments

The following instruments comprised the questionnaire that the subjects completed. The three components appeared collectively and consecutively. Together they aimed to address the multi-faceted research problem. The compiled survey was reviewed by three cheerleading coaches with many years of subject matter expertise to assess the relevance and application of the questions from the cheerleading perspective.

McCrea Concussion Reporting Questionnaire

The first instrument utilized in this research was a questionnaire used by McCrea et al¹⁰ that measured unreported concussion in high school football players. It was modified with permission for this study to apply to cheerleading instead of football (see Appendix 3). The original questionnaire was designed to “investigate the frequency of unreported concussion among high school football players to estimate more accurately the overall prevalence of concussion.”¹⁰ It supplied a definition for concussion and then asked about the number of concussions experienced prior to the past calendar year as well as during the last calendar year, based on that definition. If participants reported that they did experience a concussion during the past year, then they were asked if they reported the injury and to whom they reported it. Subsequently, if they selected that they suffered

a concussion but did not report it to anyone, they were asked to choose why from the following: “didn’t think it was serious enough, didn’t know it was a concussion didn’t want to be pulled out of the game or practice, didn’t want to let down teammates, or other reason.”¹⁰

Injury Reporting Questionnaire

The injury reporting and questionnaire consists of 21 cheerleading-related statements tied to a four-point Likert scale (see Appendix 4). There is no “neutral” value available for subjects to select. The four-point Likert scale was chosen for the instrument in order to drive subjects to formulate an opinion on each statement. The statements pertain to the individuals’ feeling about reporting injuries, continuing participation without reporting injuries, and perceived pressures relating to injury reporting. The statements were developed by the principal researcher to represent constructs of the Health Belief Model and the Protection Motivation Theory as applicable to cheerleading. This portion of the questionnaire is valuable and unique because it addresses the social and psychological factors that contribute to injury reporting. It is important to gain a better understanding of these determinants of injury reporting behaviors so that health and safety interventions can be improved and aimed in directions to increase effectiveness.

Participation Environment Questionnaire

Participants also filled out a short questionnaire about their participation environment (see Appendix 5). It included information such as their age, sex, positions

on team (i.e., base, flyer, tumbler, spotter, mascot), years of cheerleading experience, and the level of coaching and medical coverage during school-sponsored participation. They were also asked if they have ever received any education about concussions or head injuries and by whom. Using the data obtained through these instruments, statistics on the rates of reported and unreported concussion and the accessibility of medical care were calculated.

Procedures

The coaches and athletic trainers of the NCAA Big 12 Conference were contacted by e-mail regarding the nature of the study and requesting the names and e-mail addresses of their cheerleading squad members (see Appendix 1). The coaches were also sent a second e-mail ten days later. The individual squad members were then contacted about participating in the online research study (see Appendix 2). They were informed about the research procedures and their rights as a research participant as approved by the Institutional Review Board of Oklahoma State University. The e-mail contained a direct link to the secure Web site set up for the questionnaires. Reminder e-mails were also sent to the individual cheerleaders two days before data collection ended. Participants proceeded through answering the collective Modified Concussion Reporting, the Injury Reporting, and Participation Environment Questionnaires (see Appendix 6). No direct identifying information was returned with the data. Participants that completed the survey were then given the option to submit their e-mail address to be entered in the drawing for the four iTunes gift cards. The drawing had its own separate Web site subsite file so the e-mail addresses were not correlated to the questionnaire responses.

Data Treatment and Analysis

The FrontPage survey was checked to ensure that all button options and entry fields were functioning properly and that the data was accurately retrieved from the server. Statistical analyses to test the hypotheses were conducted using the data received from the FrontPage Web site using the SPSS version 17.0 for Windows software.

CHAPTER IV

RESULTS

Concussions in sport are a particularly salient health concern for the NCAA and athletic world in general. Cheerleading has a place in the dilemma, and research investigating the health behaviors of athletes is critical. The aim and hypotheses of this study centered around identifying if individuals with symptoms of a concussion simply choose consciously to disregard their symptoms, if they feel pressured to continue by teammates and coaches, or if the problem of underreporting stems from another source, such as a lack of knowledge regarding symptoms or health risks. Identifying the factors that influence concussion symptom reporting will provide valuable avenues for education and intervention development and implementation in cheerleading in order to decrease health risks and improve outcomes.

Description of the Population

E-mails were sent out to 168 cheerleaders from four universities within the NCAA Big 12 conference. Data responses were received from 40 cheerleaders, for a response rate of 23.81%. Females constituted 67.5% of respondents and males constituted 32.5%. The mean age of the respondents was 20.55 ± 2.087 years. Members of large co-ed cheerleading squads made up 65.0% of the participants, small co-ed and

all-girl cheerleaders each represented 17.5% of respondents. The cheerleaders were on their squads for an average of 2.10 ± 1.128 years and had a mean of 7.56 ± 3.892 years of total cheerleading experience. The cheerleaders reported an average of 3.10 ± 0.744 official practices each week. All of the cheerleaders who responded reported having access to their universities' athletic training services.

Data Results

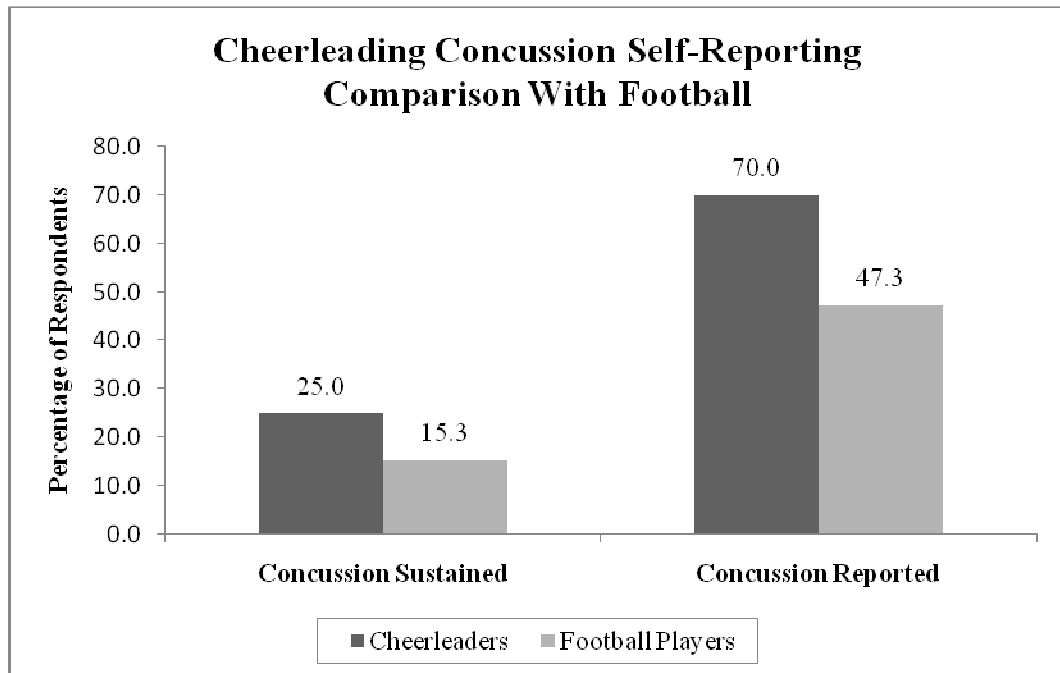
The data was analyzed using the SPSS version 17.0 for Windows. The individual hypotheses were tested as described in the following sections.

Hypothesis 1

It was hypothesized that cheerleaders in the NCAA Big 12 conference would be less likely to self-report concussion symptoms they experienced compared to high school football players. The sample of cheerleaders in this study is being compared to the sample of high school football players from a study by McCrea et al,¹⁰ since the same questionnaire instrument was used. A total of 10 cheerleaders responded that they did get a concussion from participating in cheerleading over the past year (25% of the respondents). Of the 10 cheerleaders that sustained a concussion, seven of them answered that they reported the concussion (70% of the respondents). The study of high school football players had a much larger sample size ($n=1,532$), nevertheless, 15.3% of their respondents reported that they sustained a concussion during the past season.¹⁰ Of those football players who stated that they sustained a concussion, only 47.3% responded that they reported the concussive event.¹⁰ The collegiate cheerleaders had a higher

percentage of individuals concussed during the year but they were actually more likely to report their concussions as compared to the sample of high school football players (see Figure 1); therefore, Hypothesis 1 is rejected.

Figure 1



Hypothesis 2

It was hypothesized that concussion symptoms would most frequently be self-reported by the NCAA Big 12 cheerleaders to athletic trainers. The seven cheerleaders in this study who did self-report their concussion symptoms most commonly did so to an athletic trainer (see Table 1). Concussion injuries were reported less frequently to coaches, parents, teammates, or other people. The two individuals who reported their concussions to other people both listed a “doctor” as their response. Respondents were asked to check all that apply, therefore the categories were not mutually exclusive, as was

also the case in the analysis of McCrea et al.¹⁰ Seven of the 10 cheerleaders reported their symptoms to an athletic trainer (see Table 1). Hypothesis 2 can be accepted.

Table 1

People Informed About Concussions	
Concussion Reported to:	Number of Respondents
Athletic Trainer	7
Coach	5
Parent	5
Teammate	5
Doctor	2
Categories are not mutually exclusive; respondents asked to check all that apply.	

Hypothesis 3

It was hypothesized that not wanting to be held out of participation would most frequently be reported as the reason NCAA Big 12 cheerleaders do not self-report the concussion symptoms they experience. The reason most commonly given for a concussion not being self-reported was that the cheerleaders did not think the injury was serious enough to warrant medical evaluation (see Table 2). All three individuals who did not report their concussions selected that they did not think it was serious. Two of the three cheerleaders reported that they did not want to be held out and also that they did not know it was a concussion (see Table 2). The one respondent who supplied another reason entered, “When they are minor, just go home and sleep.” None of the three reported not wanting to let their team down as a reason they did not report their

concussions. These responses illustrate a lack of knowledge about concussion injuries, even though the number of respondents was low. The top three most frequent responses also reflect the trend observed in the study of high school football players who were asked the same question.¹⁰ Hypothesis 3 is rejected.

Table 2

Reasons Concussions Not Reported	
Why Concussion Not Reported:	Number of Respondents
Did not think it was serious enough	3
Did not want to be held out of practice	2
Did not know it was a concussion	2
Other reason	1
Did not want to let down teammates	0
Categories are not mutually exclusive; respondents asked to check all that apply.	

Hypothesis 4

It was hypothesized that there would be no statistically significant difference in the incidence of concussions between female and male NCAA Big 12 cheerleaders. Nine female cheerleaders reported that they had sustained a concussion over the previous year. Only one male cheerleader reported that he had suffered a concussion over the previous year. There were a total of 15 concussions among the nine female cheerleaders, equaling a mean of 1.67 ± 0.87 concussions. The one male cheerleader reported suffering two concussions. A comparison of the incidence of concussion between males and females over the past year is not valid, however, due to the insufficient amount of data.

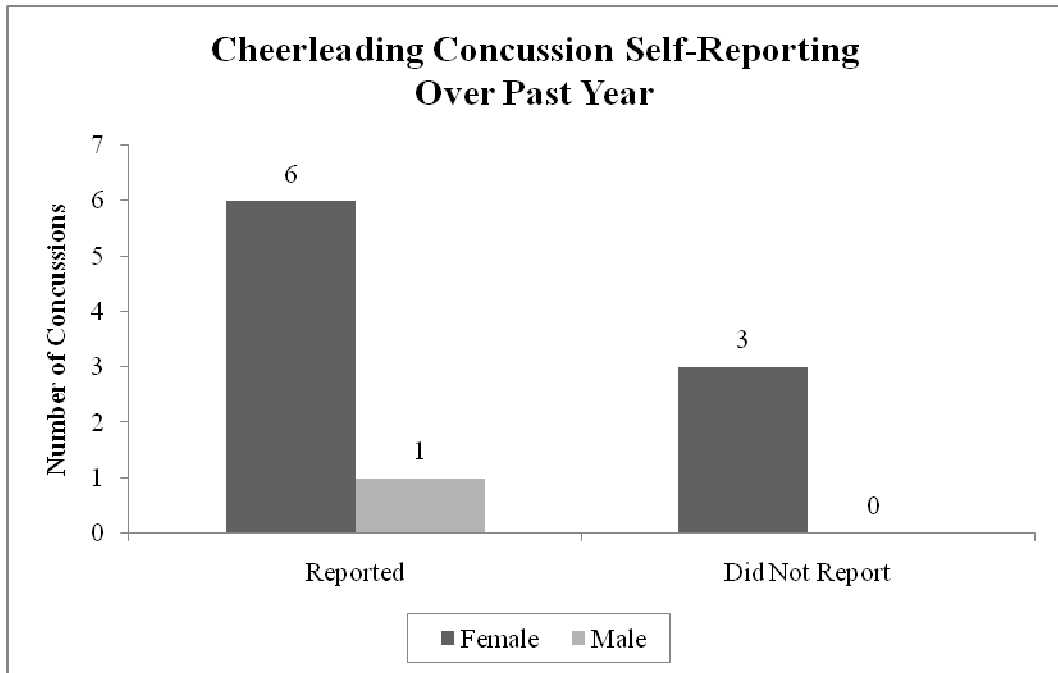
Participants were also asked in the survey to respond about their history of concussion prior to the past 12 months, therefore Hypothesis 4 was also tested with the information supplied for that time frame. Fifteen females and eight males reported that they had a history of concussion prior to the previous 12 months. The females had an average number of concussions of 1.47 ± 0.83 compared to the males who had an average of 3.25 ± 2.25 concussions prior to the last year. An independent samples *t* test was then conducted that confirmed females suffered statistically significant fewer number of concussions than males ($t = -2.775$) ($p < 0.05$). This analysis may indicate an increased incidence of concussion in male cheerleaders compared to females. Hypothesis 4 can be rejected when looking at the data responses on the incidence of concussions prior to the previous 12 months.

Hypothesis 5

It was hypothesized that male NCAA Big 12 cheerleaders would be less likely than females to report concussion and injury symptoms at the time of injury. This hypothesis was established to investigate the researcher's belief that males would be more selective about injury reporting than females due to self-presentational concerns and in defense of a potential threat to masculinity. Of the 10 cheerleaders that responded they had sustained concussions over the previous year, six of them were females that also said they reported their concussions. One male sustained and reported his concussion symptoms over the past year. The three cheerleaders who did not report their concussions were all females (see Figure 2). Females were less likely to report their

concussion symptoms than males with that line of examination, though there is insufficient data for a valid statistical comparison of this sample.

Figure 2



An additional approach to investigating Hypothesis 5 was established by setting up a subscale to measure if males would be more likely than females to modify their injury reporting. Questions 14, 15, 16, 23, and 26 (see Appendix 4) were used to create the reporting subscale. The questions address the cheerleaders' tendency to curtail or alter symptom reporting due to certain factors. Question 26, asking them to state the extent to which they feel concussions are serious injuries, was reverse coded in order to be added in and averaged with the other four questions. The females had a mean response average of 2.758 ± 0.421 and the males had a mean of 2.554 ± 0.578 on the subscale. An independent samples *t* test was then used to compare males' and females'

reporting subscale averages. There were no statistically significant differences between the two groups. Hypothesis 5 is rejected using the subscale approach to compare the modification of symptom reporting between males and females.

Hypothesis 6

It was hypothesized that NCAA Big 12 cheerleaders would agree with statements that perceived social pressures influence injury self-reporting. Perceived social pressure was measured by forming a subscale to create a total pressure score from questions 9, 10, 12, 17, and 18 (see Appendix 4). Together the five questions address possible sources of pressure to continue participation despite injury that may confront cheerleaders (i.e., themselves, coaches, teammates, audience). An individual's subscale score can range from 1.0 to 4.0 (it is the sum of their answers for the five questions, divided by five); individuals with a score of 2.5 or higher on average agreed with the statements included in the subscale. There was almost a complete range of subscale scores given by the 39 cheerleaders that answered all of the subscale questions (see Table 3). Three individuals even scored the maximum value on the five questions, indicating they fully agreed with each pressure-related statement. On average, 71.8% of the cheerleaders agreed with the subscale statements, represented by a score of 2.5 or higher. This indicates the cheerleaders perceive pressures from their coaches, teammates, and audiences to continue participation despite injury symptoms. They also place pressure on themselves to continue participating, especially when they perceive that there are not any alternate cheerleaders available for their position(s) on the team. Hypothesis 6 can be accepted

since the majority of the cheerleaders agreed with the statements in the subscale on average.

Table 3

Social Pressure Subscale Averages			
Social Pressure Subscale Average	Frequency	Percent	Cumulative Percent
1.2	1	2.6	2.6
2	1	2.6	5.1
2.2	4	10.3	15.4
2.4	5	12.8	28.2
Disagree Total	11	28.2	-----
2.6	4	10.3	38.5
2.8	7	17.9	56.4
3.0	3	7.7	64.1
3.2	3	7.7	71.8
3.4	3	7.7	79.5
3.6	4	10.3	89.7
3.8	1	2.6	92.3
4	3	7.7	100.0
Agree Total	28	71.8	-----
Total	39	100.0	100.0

CHAPTER V

CONCLUSION

This study attempted to identify factors that affect concussion symptom self-reporting among NCAA Big 12 conference cheerleaders. A mixture of ages, experience levels, skills, and squad types increased the ability to generalize the results to the collegiate cheerleading population as a whole. Six hypotheses were tested and the results are discussed further in the following section.

Discussion

Findings of statistical significance in this study were limited due to the small number of respondents. There is also a lack of previous research against which the present study can be compared. Many interesting observations can still be made, however, when looking at the results.

One such detail is that, even among a small sample size, 25% of the cheerleaders reported they had sustained a concussion over the past year and 60% reported they had sustained a concussion prior to the past year. Concussions are considered a significant health issue for collegiate cheerleaders given this data. When compared to the high school football players in McCrea et al,¹⁰ a larger percentage of cheerleaders (25%) sustained a concussion over the past year than the football players (15.3%). The

collegiate cheerleaders did have a better rate of reporting (70%) than the high school football players (47.3%) though. It is possible that collegiate cheerleaders are more knowledgeable or have had more experience with concussions than high school football players. It is also possible that collegiate athletes have better facilitators to reporting, especially if they have improved access to athletic trainers and coaches trained to be vigilant for concussion injuries. Further research should examine if that pattern is mirrored in other sports and other levels of participation.

The three individuals in this study who did not report their concussions were all female. This could not be considered a statistically significant finding due the small number of concussed individuals in the sample; however, it is still noteworthy. Research with a larger sample could help to confirm or refute the existence of reporting differences between male and female cheerleaders. Differences in previous sport participation may contribute to possible reporting tendencies between sexes. Female cheerleaders generally grow up participating in cheerleading or gymnastics, while males frequently have played other sports growing up. It is possible the variation in sport participation history has sex-dependent effects on symptom self-reporting.

Another finding of interest was the statistically significant difference in the incidence of concussions between female and male cheerleaders prior to the past year. Females sustained statistically fewer concussions, indicating an increased incidence in male cheerleaders. Previous literature has observed similar trends of concussion-related sex differences.^{35,39} Men have been observed to have a greater number of concussions but returned to participation faster than females.³⁵ It has also been documented that women experience greater post-concussive neurocognitive deficits, though men

experience greater symptom frequency and severity.³⁹ The exact mechanisms and reasons for these observed sex-based differences are not fully known or understood.^{23,35,39} Further research is needed to determine the extent of these differences²³ and the full magnitude of influence that they exert on concussion symptom self-reporting. More research with cheerleaders is certainly merited, especially since it is one of the few competitive activities that have co-ed participation thereby allowing for same-sport sex comparisons.

This study also revealed that cheerleaders most frequently reported their concussions to their athletic trainers. Cheerleader concussion reporting also parallels that of the high school football players in McCrea et al,¹⁰ with reporting to athletic trainers being followed by coaches, parents, teammates, and then doctors. All of the universities whose cheerleaders participated in this study afford their squads coverage by certified athletic trainers and access to the athletic training room, though that is not the case everywhere. Approximately two-thirds of the cheerleaders reported having a certified athletic trainer at all of their practices and the remaining third reported that they had a certified athletic trainer at 75% of their practices. Additionally, 75% of the cheerleaders who stated that they have received education about concussions received it from athletic trainers. Over 86% of individuals agreed that they are more likely to report an injury if there is an athletic trainer present. Athletic trainers can build a rapport with the cheerleaders and act to reduce barriers to concussion reporting. They are a crucial link between the athletes and the healthcare system, health education, and ultimately a safe return to participation. Smaller NCAA Division I schools and those in other NCAA divisions do not always have similar amenities in place for their cheerleading programs.

Budgeting is always a concern with athletics programs at every level and cheerleading does not receive as much focus and money as other NCAA-regulated and revenue-generating sports. This study, however, aids in illustrating the value of allocating funding for onsite and accessible athletic trainers for cheerleading.

Reflecting the trend illustrated in previous literature⁷ and in the McCrea et al¹⁰ study of unreported concussion in high school football players, cheerleaders' lack of knowledge about the nature of concussions is a significant issue. The cheerleaders most frequently selected that they did not report their concussions because they did not think they were serious enough. Not wanting to be held out of practice or competition and not knowing it was a concussion were selected as the next most frequent reasons.

Educational initiatives clearly need to be developed to reduce that knowledge gap, if a lack of knowledge is in fact the problem. These results were in not in agreement with Hypothesis 3 or the idea that athletes consciously choose to not self-report concussion symptoms because they do not want to be held out. It is possible that with a greater sample size of collegiate cheerleaders the reason frequencies might be altered, however, and the idea that the athlete mentality^{5,7} of selective reporting may truly guide self-reporting in many instances. It is for these reasons that educating all of the relevant parties becomes especially crucial. Coaches, parents, family members, and friends all need to be educated along with the cheerleaders about the signs and symptoms of concussion, the proper management of concussion injuries, and the risks associated with a premature return to participation.

While the majority of the cheerleaders in this study reported the concussions they experienced, the cheerleaders' responses to certain questions about their injury reporting

raise cause for concern. Three-quarters of the cheerleaders in the study acknowledged that they have suffered an injury they knew they should seek medical attention for but instead continued to participate. An alarming 85% of the cheerleaders reported that they knew a teammate that was experiencing concussion or injury symptoms and still continued to participate. A disconnect appears to exist when 70% of the cheerleaders say they self-reported their concussions yet later on in the survey 75% of them admit they have experienced a concussion or injury they knew they should seek medical treatment for but continued to participate anyway. Additionally, 67.5% of the cheerleaders stated that at some point they have experienced a return of injury symptoms due to resuming cheerleading participation too quickly post-injury. And, 96.3% of those individuals continued to participate despite the return of symptoms.

Some of the overall discrepancy in self-reporting observed with those questions is likely due to the inclusion of the word “injury” along with concussions but, regardless it is disconcerting that a large majority of the cheerleaders are consciously continuing to participate when they know they or their teammates should stop and seek medical attention for an injury. This again is likely affected by cheer athletes being unique in that they have a certain mentality about playing through pain^{7,27} and an intrinsic motivation to continue participating despite health complications and risks.^{5,7} Clearly, this disparity needs to be addressed and further investigated. The risk of injury to one or more cheerleaders is increased when a teammate continues to participate while experiencing concussion or injury symptoms; therefore, it is imperative that effective interventions are established to decrease the rates of non-reporting.

Collegiate cheerleaders' perceptions of pressure from their coaches, teammates, audiences, and even themselves, may play an underemphasized role in their continued participation despite the presence of injury symptoms. On average, 71.8% of the cheerleaders agreed with the statements included in the perceived social pressures subscale that was created to get a sense of the total pressure perceived by the cheerleaders. Previously proposed sources that affect reporting include feeling pressured by coaches, teammates, fans, media, parents, and placing pressure on one's self.^{5,25,27} These sources, both independently and collectively, are areas that can be targeted for future interventions and education initiatives. Pressures may vary by sport and level of participation and it is critical that these specific pressures are identified and addressed in order to improve injury reporting and reduce health risks.

Getting cheerleaders and other athletes to engage in the protective behavior of reporting concussion injuries is two-fold. It is not sufficient to simply educate athletes properly or to manage injuries as they occur. Concussions cannot be completely prevented in athletics,^{23,34} but optimizing self-reporting in order to minimize participation by symptomatic individuals involves both a preventive component as well as a reactive component. Ultimately athletes, coaches, parents, and healthcare providers must be knowledgeable about the signs, symptoms, and risks associated with concussions (preventive component) but they must also understand those factors and be persuaded to report concussions when symptoms do occur (reactive component) so they can be managed properly.^{1,7,9-10,12,23-24,29,34} The concept of self-reporting is inherently in opposition to the athlete mentality of playing through pain^{5,7} and educational initiatives

should be designed that utilize health behavior theories to reduce barriers to self-reporting and stressing the benefits.

Theory-based interventions will be essential for achieving optimal self-reporting. The Health Belief Model (HBM) has been used to help reduce athletes' use of performance enhancing drugs⁵¹ and could be used similarly to help reduce the likelihood athletes participate while injured. The HBM can provide the framework for structured interventions that strive to increase the likelihood that reporting concussion symptoms will be perceived as beneficial. The Protection Motivation Theory (PMT) could also be utilized to help influence athletes' perceptions of the severity of concussions, their vulnerability to concussions, and their success at self-reporting concussions.^{52,54} The PMT has been used with athletes to measure and improve rehabilitation adherence⁵⁵⁻⁵⁶ and decrease performance enhancing drug use.⁵¹ PMT could also be used to more accurately convey the severity of concussions and vulnerability that cheerleaders have to them, similar to the approach used by antismoking campaigns.⁵⁴ Both the HBM and the PMT address an individual's perception of a health issue and, therefore, would be valuable in the development of educational initiatives.⁴⁸ Self-efficacy is also vital to concussion self-reporting and should be incorporated into any intervention or educational programs, on both the individual and the team levels. Perceived pressures must be minimized and social support networks increased to increase self-efficacy, and as a result concussion self-reporting.

Conclusions

Concussions are a pertinent health issue for cheerleaders. It is imperative that they are recognized, reported, and properly managed for the safety of everyone participating. A statistically significant finding of this study was that the female respondents sustained a significantly lower number of concussions prior to the past year than the males. Other findings include that concussions were most commonly self-reported by cheerleaders in the NCAA Big 12 Conference to athletic trainers and that the most common reason for not reporting a concussion was that it was not thought to be serious enough. The majority of the collegiate cheerleaders in this study also agreed on average that they perceived social pressures that influenced their injury reporting. The issue of concussion symptom self-reporting among cheerleaders is multi-faceted and merits further study in order to gain a clearer, more complete understanding of the influencing factors and how to improve self-reporting. NCAA universities need to be prepared to deal with concussion injuries that result from participation to members of their cheerleading programs. The value of onsite certified athletic trainers should not be underestimated; they provide valuable concussion injury recognition, management, and education. Everyone entrusted with the care and supervision of cheerleading participants needs to be knowledgeable and cognizant of potential concussion incidents. The use of baseline concussion symptom testing and a multi-modal return-to-play approach are also supported and should be utilized with cheerleading athletes as is done with other sports that have a high-risk for concussion, especially given the increased potential risk to other participating team members if a cheerleader participates under the influence of concussion symptoms. Individual- and community-based educational initiatives need to

be developed to aid in improving concussion symptom self-reporting among collegiate cheerleaders.

Recommendations

1. Further research should be conducted with cheerleading, especially regarding concussion self-reporting among cheerleaders.
2. Similar studies should be conducted with a larger sample size to allow for thorough statistical analysis.
3. Structured injury and concussion surveillance is needed in order to improve accurate documentation of such events in cheerleading.
4. Colleges and universities in the NCAA should recognize the athleticism, skill level, and risks involved with their cheerleading programs. They need ensure they are prepared to properly manage injuries that result from participation.
5. Concussions are often reported to certified athletic trainers by cheerleaders and the value of athletic trainers should not be underestimated in the recognition and proper management of concussions and injuries. Collegiate cheerleaders should have access to the knowledge and treatment of certified athletic trainers and supporting medical staff.
6. Educational initiatives should be developed that not only involve concussion education but that also teach athletes, coaches, parents, and healthcare providers about the social pressures that cheerleaders perceive when they get injured.

7. Research investigating sex-related differences pertaining to concussion and the long-term effects of concussions needs to continue in order to add to the body of knowledge about the ambiguous aspects of concussions.

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APPENDIX 1

E-MAIL TO COACHES AND ATHLETIC TRAINERS

E-MAIL TO COACHES AND ATHLETIC TRAINERS

Subject: Cheerleading Thesis Research Study

Dear _____ ,

My name is Kathleen Martin and I am a graduate assistant athletic trainer at Oklahoma State University and I work with our cheerleading team. I am currently working on my thesis and I am interested in investigating the factors that affect concussion symptom reporting among collegiate cheerleaders. In order to get a good sample I am going to look at cheerleading squads that are officially sponsored by or affiliated with their schools in the NCAA Big 12 conference. As you know the NCAA does not recognize cheerleading as a sport, and there has not been as much research focusing on cheerleading as on other officially recognized sports. Research in this area would contribute valuable information towards greater knowledge and understanding on the issue of concussion in sports. Ultimately this research will specifically contribute to improved care, athlete education, and concussion injury management for cheerleaders. Participants in the study will be asked to voluntarily complete a short three-part questionnaire, which will take approximately 10-15 minutes total.

If you are willing to, I would appreciate it if you could email me the names and email addresses of your **2008-2009** cheerleading squad members and of any mascots that interact with your cheerleading squads in performances. I will then send the individuals a recruitment email asking for their voluntary participation in the study. The email will also contain a direct link to the questionnaires on a secure website, and from there they can participate anonymously.

I will not be selling or releasing the names or email addresses of these individuals to anyone. My thesis committee and I will be the only people to have access to any of the contact information. The names and email addresses will be destroyed once they are sent a recruitment email. If they submit the survey by June 22, the participants will have the opportunity to submit their email address along with the survey to be entered into a random drawing for the chance to win one of four \$25.00 iTunes gift cards.

If you have any questions please do not hesitate to contact me or my thesis advisor. Thank you very much for your time and assistance with my thesis research.

Best regards,
Kathleen Martin

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APPENDIX 2

E-MAIL TO CHEERLEADERS

E-MAIL TO CHEERLEADERS

Subject: Cheerleading Questionnaire Research

Dear _____ ,

You are being contacted about participating in a thesis research study looking at the rates and reporting of concussions in cheerleaders, specifically among cheerleaders officially affiliated with the schools in the NCAA Big 12 conference. This study is designed to investigate the factors that affect whether or not cheerleaders report concussion symptoms and why individuals may continue to participate despite experiencing symptoms of a head injury.

You have the opportunity to contribute valuable information on a topic that will ultimately result in better care of and education regarding concussions, particularly for cheerleaders. You may gain a greater understanding of concussion signs and symptoms through your participation in the study as well. Your participation is completely voluntary, however, and there will be no penalty if you do not participate. If you do choose to respond to the survey and do so by June 22, 2009, you will have the **opportunity to win one of four \$25.00 iTunes gift cards**. You will have the opportunity to provide your email address along with the survey and the **four winners will be randomly selected from surveys completed by June 22**. The winners will be contacted via the email address provided to arrange for the delivery of the gift cards. No survey responses will be linked to the email addresses.

If you choose to participate in this study you will be asked to fill out a short three-part questionnaires and will take approximately 10-15 minutes total. The first questionnaire will ask you questions about concussion injuries you have experienced and will take about 5 minutes to complete. The second questionnaire consists of a series of statements about cheerleading injuries and asks whether you agree or disagree with each statement. The third questionnaire consists of questions regarding basic information about your cheerleading squad involvement, medical and coaching coverage, and concussion education. The second and third parts will take about 10 minutes to complete.

There is no cost to you nor any foreseeable risk associated with your participation in this research. The questionnaires are accessed via the link below to a secure website. You will be submitting your responses anonymously online and you can withdraw from the study at any time if you desire and without any penalty. Any information provided will be kept confidential and will not be released or sold to any coaches, schools, medical staff, etc. with any identifying information attached. You will not be contacted further by the researchers following participation unless you win a gift card.

If you have any questions or concerns about the research study, please contact the principal investigator or the thesis advisor:

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If you have questions about your rights as a research volunteer, you may contact:
Dr. Shelia Kennison, IRB Chair
219 Cordell North, Stillwater, OK 74078
405-744-1676
irb@okstate.edu

Thank you for your time, and in advance for your participation. If you are interested and willing in participating please click on the following link to proceed directly to the study:

By clicking on the link, I acknowledge that I have read this email and fully understand the nature of the study. I am participating in it freely and voluntarily. I also understand that I can choose to discontinue my participation in this research at any time without any penalties.

<http://frontpage.okstate.edu/coe/kathleenmartin/>

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APPENDIX 3

MODIFIED MCCREA CONCUSSION QUESTIONNAIRE

CONCUSSION QUESTIONNAIRE

USE THE FOLLOWING DEFINITION OF CONCUSSION TO ANSWER THE QUESTIONS BELOW:

Definition of Concussion: A concussion is a blow to the head followed by a variety of symptoms that may include any of the following: headache, dizziness, loss of balance, blurred vision, “seeing stars,” feeling in a fog or slowed down, memory problems, poor concentration, nausea, or throwing-up. Getting “knocked out” or being unconscious does NOT always occur with a concussion.

1. Did you ever have a concussion prior to May 2008?

_____ Yes ⇔ How many concussions before May 2008? _____
_____ No

2. How many times total prior to May 2008 were you “knocked out” or unconscious from a concussion? _____

NOW TELL US ABOUT MAY 2008 TO MAY 2009:

3. Did you have any concussions participating in cheerleading this past year?

(Check “Yes” if you think you might have had a concussion—even if you did not tell anyone)

_____ Yes ⇔ How many concussions do you think you had this year? _____
(Go to #4)
_____ No (Go to #7)

4. Did you report your concussion(s) to anyone?

_____ Yes (Go to #5)
_____ No (Go to #6)

5. To whom did you report your concussion? (Check all that apply)

_____ Athletic Trainer _____ Coach _____ Parent _____ Teammate
_____ Other (Who?) _____

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

_____ Didn't think it was serious enough
_____ Didn't know it was a concussion
_____ Didn't want to be pulled out of the game or practice
_____ Didn't want to let down teammates
_____ Other (Why) _____

APPENDIX 4

INJURY REPORTING QUESTIONNAIRE

INJURY REPORTING QUESTIONNAIRE

USE THE FOLLOWING DEFINITION TO RESPOND WHEN THE STATEMENT REFERS TO AN INJURY:

Definition of Injury: An injury is a health issue occurring during cheerleading activity participation and which results, or would likely result, in a loss of at least one day of practice or participation. A concussion is considered to be a type of injury.

7. I think cheerleading is risky.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

8. I feel injuries are an expected part of cheerleading.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

9. I feel pressure from my teammates to continue participating even if I get injured.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

10. I feel pressure from my coach to continue participating even if I get injured.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

11. I feel worried to tell my coach about an injury.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

12. I feel I put pressure on myself to continue participating when I get injured.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

13. I feel like I have to continue participating after an injury occurs if there is not an athletic trainer or health care provider present to whom I can report it.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

- 14. I am more likely to report an injury if there is an athletic trainer or health care provider present to whom I can report it.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 15. I decide to seek medical attention for an injury depending on the amount of time until a competition or performance.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 16. I decide to report an injury depending on whether or not I have had a similar injury before.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 17. I feel I am unable to stop participating when I get injured because there is no one else on the team who can fill my position.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 18. I feel pressure to appear physically 'fit' and 'tough' when cheerleading in front of a crowd.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 19. I feel my teammates will think I am 'weak' if I stop participating because of concussion injury symptoms.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 20. I feel my coach will think I am 'weak' if I stop participating because of concussion injury symptoms.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree
- 21. I would view one of my male teammates as 'weak' if he stopped participating because of concussion injury symptoms.**
_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

22. I would view one of my female teammates as ‘weak’ if she stopped participating because of symptoms of a concussion injury.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

23. I feel I am capable of continuing cheering despite symptoms of a concussion injury.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

24. I feel comfortable with the possibility of stunting with a partner who is experiencing symptoms of a concussion injury.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

25. I would continue stunting with a partner who I know is experiencing symptoms of a concussion injury.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

26. I feel concussions are serious injuries.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

27. I feel that being a cheerleader is a significant part of my life.

_____ Disagree _____ Tend To Disagree _____ Tend To Agree _____ Agree

APPENDIX 5

PARTICIPATION ENVIRONMENT QUESTIONNAIRE

PARTICIPATION ENVIRONMENT QUESTIONNAIRE

28. **Have you known a teammate that was experiencing concussion symptoms or an injury and continued to participate anyway?**
_____ Yes _____ No
29. **Have you suffered an injury you knew you should seek medical attention for, yet continued to participate anyway?**
_____ Yes _____ No (If “No,” go to #32)
30. **Did you choose not to report the injury because you were doing something you were not supposed to be doing when you got hurt?**
_____ Yes _____ No
31. **Have you ever suffered an additional injury while participating injured?**
_____ Yes _____ No
32. **Have you ever experienced a return of injury symptoms due to resuming cheerleading participation too quickly after any injury?**
_____ Yes _____ No (If “No,” go to #34)
33. **Did you continue to participate despite the return of symptoms?**
_____ Yes _____ No
34. **Have you ever received education about head injuries and/or concussions?**
_____ Yes _____ No (If “No,” go to #38)
35. **Who did you receive educational information from? (Check all that apply)**
_____ Athletic Trainer _____ Doctor _____ Coach _____ Parent
_____ Other (Who?) _____

36. Were you educated about concussions as a result of suffering an injury or prior to injury?

Yes, after the injury Yes, before the injury Both

37. How many years old were you when you were first educated about concussions? _____

38. Approximately what percent of the time do you have a certified coach at your official school-sponsored practices?

100% 75% 50% 25% 0%

39. Approximately what percent of the time do you have an athletic trainer at your official school-sponsored practices?

100% 75% 50% 25% 0%

40. Were you required to complete baseline concussion testing in order to participate in cheerleading at your university?

Yes, before participation

Yes, but not prior to participation

No

41. Are you provided access to your university's athletic training/healthcare services?

Yes No (If "No," go to #44)

42. If yes, do you utilize those services?

Yes No

43. Do you feel comfortable using those services?

Yes No

44. **University:** _____
45. **Age:** _____
46. **Gender:** _____ Female _____ Male
47. **Type of Squad:** _____ Large Co-Ed _____ Small Co-Ed _____ All-Girl
48. **Years on Squad:** _____
49. **Total Years of Cheerleading Participation:** _____
50. **Primary Role(s) on Squad:** (Check all that apply)
_____ Base _____ Flyer _____ Tumbler
_____ Spotter _____ Mascot
51. **Typical Number of Official Practices Each Week:**
_____0 _____1 _____2 _____3 _____4 _____5 _____6 _____7

If you want to be entered for a chance to win one of four \$25.00 iTunes gift cards please enter your email address below. You will not be contacted further unless you are a winner. No survey responses will be linked to your email and no identifying information will be released.

Thank you for your participation in the survey.

APPENDIX 6

INSTITUTIONAL REVIEW BOARD APPROVAL FORMS

Oklahoma State University Institutional Review Board

Date: Thursday, January 15, 2009
IRB Application No ED08187
Proposal Title: Factors Affecting Concussion Symptom Reporting Among Division I Collegiate Cheerleaders
Reviewed and Processed as: Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 1/14/2010

Principal Investigator(s):

Kathleen E. Martin 4599 N. Washington, Apt. 35 Stillwater, OK 74075	Suzanne Konz 194 Colvin Center Stillwater, OK 74078
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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

✓ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,



Shelia Kennison, Chair
Institutional Review Board

Oklahoma State University Institutional Review Board

Date Thursday, May 21, 2009 Protocol Expires: 1/14/2010
IRB Application ED08187
Proposal Title: Factors Affecting Concussion Symptom Self-Reporting Among Division I Collegiate Cheerleaders

Reviewed and Exempt
Processed as: **Modification**

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s) :

Kathleen E. Martin Suzanne Konz
4599 N. Washington, Apt. 35J 180 Colvin Center
Stillwater, OK 74075 Stillwater, OK 74078

The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed. The IRB office MUST be notified in writing when a project is complete. All approved projects are subject to monitoring by the IRB

- The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

Signature:


Sheila Kennison, Chair, OSU Institutional Review Board

Thursday, May 21, 2009
Date

VITA

Kathleen Elizabeth Martin

Candidate for the Degree of

Master of Science

Thesis: FACTORS AFFECTING CONCUSSION SYMPTOM SELF-REPORTING
AMONG DIVISION I COLLEGIATE CHEERLEADERS

Major Field: Health and Human Performance

Emphasis: Health Education and Promotion

Biographical:

Personal Data: Born in Carrollton, Georgia on May 28, 1984, the daughter of Tom and Nancy Martin.

Education: Graduated from Davidson Fine Arts Magnet High School, Augusta, Georgia, in May 2002. Completed Bachelor of Science in Education degree with a major in Exercise and Sport Science and an Emphasis in Athletic Training at the University of Georgia, Athens, Georgia, in May 2007. Completed the requirements for the Master of Science in Health and Human Performance and an Emphasis in Health Education and Promotion at Oklahoma State University, Stillwater, Oklahoma, in July 2009.

Experience: Became a Certified Athletic Trainer in May 2007. Graduate Assistant Athletic Trainer for the Oklahoma State University cheerleading squad, pom squad, and men's tennis, women's tennis, and football programs from August 2007-May 2008. Graduate Assistant Athletic Trainer for the Oklahoma State University cheerleading squad, pom squad, and football program from June 2008-June 2009.

Professional Memberships: National Athletic Trainers' Association, April 2004 to present; Oklahoma Athletic Trainers' Association.

Name: Kathleen Elizabeth Martin

Date of Degree: July, 2009

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: FACTORS AFFECTING CONCUSSION SYMPTOM SELF-REPORTING AMONG DIVISION I COLLEGIATE CHEERLEADERS

Pages in Study: 73

Candidate for the Degree of Master of Science

Major Field: Health and Human Performance

Scope and Method of Study: The purpose of this research is to identify the reasons and factors that affect whether cheerleaders do or do not self-report concussion symptoms. Questionnaires were used to identify perceived psychological, social, and environmental barriers or facilitators to self-reporting concussion symptoms in order to increase concussion reporting and reduce risk of further injury due to unreported symptoms and injuries. E-mails were sent to 168 collegiate cheerleaders at four universities in the NCAA Big 12 Conference, and 40 responded. Participants completed a web-based survey that consisted of 51 cheerleading-related questions addressing individuals' concussion reporting, injury reporting, and participation environment.

Findings and Conclusions: Data was analyzed and six hypotheses tested. A statistically significant finding of this study was that the female respondents sustained a significantly lower number of concussions prior to the past year than males. Concussions were most commonly self-reported by cheerleaders in the NCAA Big 12 Conference to athletic trainers and that the most common reason for not reporting a concussion was that it was not thought to be serious enough. The majority of the collegiate cheerleaders in this study also agreed on average that they perceived social pressures that influenced their injury reporting. Concussion symptom self-reporting among cheerleaders is a multi-faceted issue and merits further study in order to gain a clearer, more complete understanding of the influencing factors. NCAA universities need to be prepared to deal with concussion injuries that result from participation to members of their cheerleading programs. The value of onsite certified athletic trainers should not be underestimated; they provide valuable concussion injury recognition, management, and education. Concussion baseline testing and multi-modal return-to-play approaches should be utilized with collegiate cheerleaders. Individual- and community-based educational initiatives need to be developed to aid in improving concussion self-reporting.

ADVISER'S APPROVAL: _____

Dr Suzanne Konz