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AN EXPLORATORY ANALYSIS OF CONCUSSIONS IN WOMEN'S PROFESSIONAL FOOTBALL

A Chapter Style Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Health in Community Health Education

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AN EXPLORATORY ANALYSIS OF CONCUSSIONS IN WOMEN'S PROFESSIONAL FOOTBALL

By Tiffany Lein

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ABSTRACT

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There is increasing concern that concussions can lead to short- and long-term neurological complications. Early research has indicated that female athletes may be at a greater risk of concussions and there also is some evidence that females have worse outcomes following a concussion than their male counterparts. While the concussion incidence rate for male football players is well-documented, data specific to female football players are lacking. Therefore, the aim of this study was to explore concussions in the Women's Football Alliance (WFA) during the 2016 football season. Out of 767 athletes who completed the survey issued electronically to all league teams, 8 (11.9%) indicated sustaining at least one concussion in practice or a game during the 2016 WFA football season. Out of the eight subjects who reported a concussion, four (50.0%) indicated sustaining one medically-diagnosed concussion and five (62.5%) indicated sustaining one non-medically diagnosed concussion. In total, nine concussions were reported. Twenty percent ($n = 1$) of athletes who sustained a non-medically diagnosed concussion failed to report it. No concussions were reported for wide receivers, quarterbacks, special teams, and defensive backs. The average return-to-play time post-concussion varied. One athlete reported returning to play within 72 hours of the concussion diagnosis. Future studies should focus on refining the concussion data collection process in addition to examining the underreporting of concussions among female football players.

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INTRODUCTION

Background

Football is one of the most popular team sports in the United States and impacts the lives of over five million athletes annually (Wong, Wong, & Bailes, 2014). According to Zember (2003), a "cerebral concussion is a relatively frequent occurrence in high-risk contact sports such as American football" (p.157). There is increasing concern that concussions can lead to long-term neurological complications. Repeat trauma to the head, including concussions, may lead to chronic traumatic encephalopathy (CTE). CTE is a progressive neurodegenerative disease that is caused by brain trauma (CDC, 2015). In addition, athletes who sustain a concussion are at risk for second impact syndrome, an acute, often fatal brain swelling condition that occurs when an athlete sustains a second concussion prior to fully recovering from the initial concussion (American Association of Neurological Surgeons, 2017).

Athletes participate in football throughout all developmental stages including youth, high school, collegiate, and professional. While female athlete participation in football purportedly is on the rise, data to support this claim are difficult to ascertain.

Recent media reports have highlighted female athletes in youth football leagues, but exact numbers on how many girls and women play football are not readily available. According to the National Federation of State High School Associations (NFSH), the total number of high school female football athletes has doubled since 2008, reaching

1,698 in 2015. Despite the increase in the number of female football athletes, male athletes still represent over 99% of the total high school football population (NFSH, 2015).

The collegiate athlete database continues to list football as a male sport and therefore, does not specify female participation. To date, there are no female athletes in the National Football League (NFL); however, there are two women's professional football leagues in the United States. The Women's Football Alliance (WFA) currently has 45 teams and the Independent Women's Football League (IWFL) has 38 teams. Based on team roster averages and league player requirements, there are over 2,400 total athletes each year (IWFL, 2016; WFA, 2016).

Concussion incidence rates are well-documented for high school and professional male football players. In fact, studies have been conducted to measure the concussion incidence rate by population. Based on the averages and approximate number of youth, high school and collegiate male football players, the risk for an individual athlete to sustain at least one concussion during the season is 1 out of 30 (3%), 1 out of 14 (7%) and 1 out of 20 (5%), respectively (Dompier et al., 2015). While information is readily available regarding concussion among male athletes, there is no current literature related to the concussion incidence rate in women's professional football. Furthermore, there is poor compliance with sport concussion reporting, which subsequently accounts for under-reporting (McCrory et al., 2005). Studies show that athletes do not want to be removed from play and athletes know that reporting symptoms might hinder their return to the game.

As far as gender is concerned, female athletes may have worse outcomes following a sports-related concussion. A study conducted in 2005 demonstrated that female athletes reported more post-concussion symptoms when compared to males and had significantly greater declines in reaction times relative to baseline levels. Furthermore, females were cognitively impaired approximately 1.7 times more frequently as a result of a concussion when compared to males (Erlanger, Webbe, & Barth, 2005).

The WFA is a women's professional football league located in the United States that was established in 2007. The WFA was designed to create the largest and most competitive women's tackle football league in the world. Women's tackle football teams and leagues have been in existence for over four decades, but the most promising growth in the sport – both in the number of teams and in the level of competition – has taken place over the last five years (WFA, 2016).

The WFA is a full-tackle women's football league. The WFA rule book is a combination of existing football rules deemed most applicable for the women's game. All players are mandated to wear a helmet, hip pads, a jersey, knee pads, a mouthpiece, pants, shoulder pads, socks, and thigh guards. Most of the equipment utilized was designed for male players; therefore, some female athletes resort to utilizing youth pads due to sizing. Currently, there is one manufacturer that produces women's-specific shoulder pads; however, these are costly and limited in size (WFA, 2017).

Purpose of the Study

WFA players served as the sample for this study. The WFA consists of teams throughout the United States divided up into two conferences which are further divided into five divisions per conference. Athletes must be at least 18 years of age to play in the

league. The athletes have a wide array of athletic experience ranging from none or very limited to playing multiple sports in high school. While less common, some of the athletes have previous high school football experience and some have previous women's football experience (WFA, 2017).

The concussion incidence rate for male football players is documented at the high school, collegiate, and professional levels for male football players. There also is some documentation of concussions for boys playing football at the youth level. While information regarding head trauma for male football players is readily available, data specific to the female population are lacking. Therefore, the aim of this study was to explore concussions in the Women's Football Alliance (WFA) during the 2016 football season.

Statement of the Problem

There is increasing concern that concussions can lead to short- and long-term neurological complications. Repeat trauma to the head, including concussions, may lead to chronic traumatic encephalopathy (CTE). According to the Centers for Disease Control and Prevention (2015), CTE is a progressive neurodegenerative disease that is caused by brain trauma, and is not limited to athletes who have reported concussions. In addition to CTE, athletes who sustain a concussion are at risk for second impact syndrome, an acute, often fatal brain swelling condition that occurs when an athlete sustains a second concussion prior to fully recovering from the initial concussion (American Association of Neurological Surgeons, 2017). Based on the current literature, sports-related concussions are a growing concern in the United States and football players are more susceptible to concussions based on the nature of the sport.

Need for the Study

Female football players were selected as the study population for this research to fill a current knowledge gap in the literature. In addition, early research has indicated that female athletes may be at a greater risk of concussions than male athletes. Within comparable sports (e.g. soccer and basketball), there is a higher concussion incidence rate among female athletes (Gessel, Fields, Collins, Dick, & Comstock, 2007). There also is some evidence that females have worse outcomes following a concussion than their male counterparts (Dick, 2009).

Research Questions

Research questions for this study were as follows:

RQ1: What was the prevalence of concussions [by diagnosis] among WFA athletes for the 2016 football season?

RQ2: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices for the 2016 football season?

RQ3: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during games for the 2016 football season?

RQ4: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices and games combined for the 2016 football season?

RQ5: What percentage of non-medically diagnosed concussions that WFA athletes sustained during the 2016 football season were **NOT** reported during the 2016 football season?

RQ6: What was the average return-to-play time post-concussion for WFA athletes during the 2016 football season?

Assumptions

Assumptions for this study were as follows:

- The league owner was willing to send the survey to all team representatives.
- The team representatives were willing to send the survey to their 2016 players.
- Players were willing to participate in the study.
- Players provided accurate concussion-related information on the survey.

Delimitations

The following delimitations were set by the principal investigator:

- The sample consisted of WFA athletes during the 2016 football season.
- The timeframe of data collection was limited to one season.

Limitations

Limitations for this study were as follows:

- No incentives were provided to encourage participation in the study.
- Selected players quit or sustained season-ending injuries which further decreased the number of athletic exposures and potential for concussions.
- The amount of contact at practices may have been limited due to player attendance, player health, and proximity to upcoming games.
- Access to the athletes was limited and based on support of the league owner and team representatives.
- The ability of the athletes to understand the survey questions and accurately recall concussion information may have been compromised due to factors such as previous concussion exposure.

- The comfort of the athletes in sharing health-related information may have influenced their responses to survey items.
- A convenience sample of athletes was used for the survey.

Definition of Terms

The following terms were used throughout this investigation:

- Athletic exposure – One WFA athlete playing in one game or practice.
- Athletic trainer – An athletic trainer, certified by the National Athletic Trainers' Association Board of Certification (NATABOC).
- Concussion – A concussion is a condition resulting from the effects of a hard blow to the head followed by a variety of symptoms that may include any of the following: blurry vision, confusion, dizziness, feeling hazy, feeling very drowsy, headache, nausea, not feeling right, and sensitivity to light or sound (American Association of Neurological Surgeons, 2017).
- Chronic Traumatic Encephalopathy (CTE) - CTE is a progressive neurodegenerative disease that is caused by brain trauma, and is not limited to athletes who have reported concussions (CDC, 2015).
- Football –A team game with 11 players on each side; also known as American football (not soccer).
- League owner – Women's Football Alliance league owner.
- Medically-diagnosed concussion – Concussion diagnosed by an athletic trainer, medical professional, or coach trained on concussions.
- Non-medically diagnosed concussion – Concussion diagnosed by an athlete, another player, or a coach not trained on concussions.

- Second impact syndrome - An acute, often fatal brain swelling condition that occurs when an athlete sustains a second concussion prior to fully recovering from the initial concussion (American Association of Neurological Surgeons, 2017).
- Team representative – Representative (coach or owner) from one of the 43 Women's Football Alliance teams.
- Women's Football Alliance (WFA) athlete – One female football player on a team that was part of the WFA in 2016.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Concussions, as a direct result of playing American football have gained recent attention in the public due to their potential harm and long-term consequences. This common injury is likely to be underreported by athletes. As such, the purpose of this literature review was to examine the prevalence, signs, symptoms, and effects of concussions in youth, high school, collegiate, and professional American football players in the United States.

Concussion Background

Concussion Definition

According to the Centers for Disease Control and Prevention (CDC), "a concussion is a type of traumatic brain injury—or TBI—caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth" (Centers for Disease Control and Prevention [CDC], 2015, para. 1). According to the 3rd International Consensus Statement of Concussions in Sports, there was unanimous agreement, however, that concussion is defined as follows:

> Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an "impulsive" force transmitted to the head.

2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.

3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.

4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.

5. No abnormality on standard structural neuroimaging studies is seen in concussion. (McCrory et al., 2009, p. 37)

This clear definition allows concussions to be assessed and compared across various football populations and across various sports. This definition also allows athletic trainers, coaches, and parents to diagnose and confirm a suspected concussion. Since concussions may result in immediate and long-term complications, proper diagnosis is vital.

Concussion Signs and Symptoms

Common signs of a concussion observed by coaching staff may include athletes that appear dazed or stunned, seem confused about their assignment or forget instruction, answer questions slowly, lose consciousness, and cannot recall events prior to or after the event (CDC, 2015). Symptoms reported by athletes may include headache, nausea, vomiting, balance problems, dizziness, sensitivity to noise, feeling sluggish,

concentration problems, and just not feeling "right" or feeling "down" (CDC, 2015). Signs and symptoms of a concussion typically are apparent shortly after the injury; however, in some cases, these symptoms may not appear for hours or days later (CDC, 2015).

Concussion Effects

Impacts of a concussion can interfere with school, social, and family relationships, participation in sports, and finances. In particular, "youth athletes pose a unique challenge, because their brains are still developing and may be more susceptible to the effects of a concussion" (Halstead, Walter, & Council on Sports Medicine and Fitness, 2010, p. 597). Appropriate recognition and management are imperative to reduce the risk of complications from concussions. As noted by Halsetead et al, "The long-term effects of concussions in athletes of all ages are a cause for considerable concern" (p. 606).

There is increasing concern that concussions can lead to long-term neurological complications. Repeat trauma to the head, including concussions, may lead to chronic traumatic encephalopathy (CTE). According to the CDC (2015), CTE is a progressive neurodegenerative disease that is caused by brain trauma, and is not limited to athletes who have reported concussions. There is no current consensus on the number or type of head trauma that will lead to CTE. Signs and symptoms of CTE may include a decline in recent memory, depression, impulsivity, aggressiveness, anger, irritability, suicidal behavior, and dementia (CDC, 2015). CTE signs and symptoms may not appear until decades after the trauma and CTE only is confirmed after death (CDC, 2015).

Female athletes may have worse outcomes following a sports-related concussion. For example, in 2005, a study evaluated 2340 male and female athletes and re-evaluated the 155 athletes who sustained a sports-related concussion. According to the investigators, "female athletes had significantly greater declines in simple and complex reaction times relative to preseason baseline levels, and they reported more post-concussion symptoms compared with males. As a group, females were cognitively impaired approximately 1.7 times more frequently than males following concussions" (Erlanger, Webbe, & Barth, 2005). Findings from the latter study were consistent with research indicating that females were more likely to experience post-concussion symptoms at 12 to 18 months after the injury (King, 2014).

Football Participation

Football is one of the most popular team sports in the United States. Athletes participate in football throughout all developmental stages including youth, high school, collegiate and professional. While football is dominated by the male population, the number of female football players is on the rise.

Youth

Over 44 million youth participate in organized sports annually and football is one of the most popular youth sports (National Council of Youth Sports, 2008). "In the United States, there are approximately 3.5 million youth football players, representing nearly 70% of all organized football" (Wong, Wong, & Bailes, 2014, p. 1). While there are a variety of youth football leagues, Pop Warner is the largest coordinated youth football program in the United States. Pop Warner Football is a national youth football league that was established in 1929. Over 250,000 youths participated in the program in

2010 through seven divisions of play that are determined by age and weight to ensure player safety (Pop Warner, 2017).

High School

According to the National Federation of State High School Associations (NFSH, 2015), over seven million athletes participated in competitive high school sports during the 2014-2015 school year-an increase of over 270,000 athletes since the 2008-2009 school year. Over one million students played football at a competition level during the 2014-2015 school year, including 11-payer, 6-player, 8-player, and 9-player football. The total number of athletes participating in football has decreased by over 27,000 since the 2008-2009 survey, even though the number of female athletes doubled to 1,698. Football was ranked the most popular boys program by participation numbers in both the 2008-2009 survey and the 2014-2015 survey (NFSH, 2015).

Collegiate

According to the NCAA Sports Sponsorship and Participation Rates Report, there were over 475,000 athletes participating in sports during the 2013-2014 school year (National Collegiate Athletic Association [NCAA], 2014). Participation increased by approximately 50,000 athletes since the 2008-2009 survey. In fact, there were 664 football teams totaling 71,291 athletes during the 2013-2014 school year; this was an increase of over 6,000 athletes and 30 teams since the 2008-2009 survey (NCAA, 2014). Football had the greatest number of male athletes compared to any other sport in both the 2008-2009 survey and the 2013-2014 survey (NCAA, 2014).

Professional

According to the National Football League (NFL, 2015), there are thirty-two active teams and each team is allowed to have fifty-three players on their roster accounting for a total of 1,696 players. "Teams are permitted to open training camp with no more than 90 players under contract and thereafter must meet two mandatory roster reductions prior to the season opener. Teams also are permitted to establish Practice Squads of up to 10 players who are eligible to participate in practice, but these players remain free agents and are eligible to sign with any other team in the league" (National Football League, 2015, p 36). The participation numbers have remained consistent over the years due to the league roster rules.

Female

While female athlete participation in football is on the rise, data to support this claim are difficult to ascertain. There have been recent media reports highlighting female athletes in youth football leagues, but no specific data are available. According to the National Federation of State High Schools (NFSH, 2015), the total number of female football athletes has doubled to 1,698. Male athletes still represent over 99% of the total high school football population (NFSH, 2015). The collegiate athlete database continues to list football as a male sport and therefore, does not separate female participation. To date, there are no female athletes in the National Football League; however, there are two women's professional football leagues. The Women's Football Alliance currently has 45 teams and the Independent Women's Football League has 38 teams with over 2,400 total athletes (WFA, 2016; IWFL, 2016).

Summary of Participation

Of all sports, football has the greatest participation amongst male youth, high school, and collegiate athletes. Over 5 million athletes participate in football annually. Some media reports indicate that Pop Warner participation has dropped in recent years; however, the official Pop Warner website does not substantiate this claim. The number of athletes participating in high school football has dropped since 2008 while the number of athletes participating in collegiate football increased over the same period of time. Female participation continues to increase, however the databases do not accurately track female participation rates.

Concussion Reporting

Concussion reporting is the first step towards preventing the short- and long-term health problems associated with sustaining a concussion. Unfortunately, there is poor compliance with sport concussion reporting, which subsequently accounts for under-reporting (McCrory et al., 2005). For example, a 2004 study of high school football players indicated that 53% of concussions in Americans are not reported (McCrea, Hammeke, Olsen, Leo & Guskiewicz, 2004). Similarly, a 2014 study of intercollegiate athletes indicated that the underreport rate was 11.8% and the potentially unrecognized concussion rate was 26.1% (Llewellyn, Burdette, Joyner, & Buckley, 2014).

Studies show that athletes do not want to be removed from play and athletes know that reporting symptoms might hinder their return to the game. According to Edwards and Bodle (2014). "Athletes at all levels of competition may have incentives to play in their next game, ranging from a high school athlete who enjoys the camaraderie of

teammates and the thrill of competition to the professional athlete who may face financial and professional repercussions of not being able to compete" (p. 131).

Concussions often occur during the course of play, making it difficult for coaching staff and athletic trainers to observe. Athletes also are hesitant to report symptoms to coaches if the concussions do not result in significant pain or disability (Chrisman, Quitiquit & Rivara, 2013).

Despite the concerns about underreporting in the general athlete population, there is little evidence specific to concussion reporting in the female population. According to a systematic meta-analysis review, females were 43% more likely to report concussion symptoms than males. At initial diagnosis of a concussion, females were more likely to report difficultly concentrating, problems with hearing/vision, headaches/migraines, emotional disturbances, and irritability. However, there was no difference in the odds of reporting post-concussion symptoms between males and females. Moreover, post-concussion symptoms were very similar, with the exception that males reported higher levels of confusion. However, females were still likely to underreport concussions (Brown, Elsass, Miller, Reed, & Reneker, 2015). The latter finding was consistent with a 2016 study of 77 high school female athletes which revealed that 32% of athletes refrained from reporting a suspected concussion (McDonald, Burghart, & Nazir, 2016).

Concussion Prevalence

Zember (2003) states that a "cerebral concussion is a relatively frequent occurrence in high-risk contact sports such as American football" (p. 157). Approximately 248,418 children under the age of 20 were treated for sports or recreation-related head injuries, including concussions, in 2009 (CDC, 2009). In addition, from

2001 to 2009, the rate of diagnosed head injuries rose 57% among children under the age of 20 (CDC, 2009).

According to a study conducted during the 2012-2013 football season using data from the Youth Football Surveillance System (YFSS), the concussion incidence rate was 0.59 concussions per 1,000 athletic exposures for practices and 1.57 concussions per 1,000 athletic exposures for games (Dompier et al., 2015). YFSS consists of data from over 3,000 athletes from 118 teams (Dompier et al., 2015). This incidence rate is similar to data from a 2014 study conducted in four states on 2,108 youth football players aged 5-15, which found an incidence rate of 0.58 concussions per 1,000 athletic exposures for practices and 1.46 concussions per 1,000 athletic exposures for games (Kerr et al., 2013). Twenty-six concussions occurred during practices and 19 concussions occurred during games (Kerr et al., 2013). A higher game incidence rate (6.16 concussions per 1,000 athletic exposures) and a lower practice incidence rate (0.24 concussions per 1,000 athletic exposures) were found in a 2011 study conducted on 468 youth football players aged 8-12 years old. Specifically, eighteen concussions occurred during games and two concussions occurred during practices. Moreover, forty-five percent of concussions resulted from head-to-head contact, 5% resulted from head-to-ground contact, 5% resulted from head-to-body contact, and 45% were indiscernible due to the nature of the play (Kontos et al., 2013). Based on the averages and approximate number of youth football players, the risk for an individual youth athlete to sustain a concussion is 1 out of 30 each season (Dompier et al., 2015).

To address the concussion crisis, the Pop Warner Football League altered some of the practice and game rules. For example, Pop Warner does not allow full-speed head-on

blocking or tackling drills in which players line up more than three yards apart. Moreover, the amount of contact at each practice must be reduced to a maximum of one-third of the practice time. In addition to other specific restrictions in the National Federation and NCAA rulebooks, no butt blocking, chop blocking, face tackling or spearing techniques are permitted (Pop Warner, 2017).

High School

Concussions represent approximately 9% of all high school athletic injuries (Gessel, Fields, Collins, Dick, & Comstock, 2007). According to the National High School Sports-Related Injury Surveillance Study, for the 2014-2015 school year, there were 1,816 football-related injuries per 486,471 athletic exposures (982 injuries/82,067 athletic competition exposures and 834/404,404 practice athletic exposures) (Center for Injury Research and Policy, 2015). Practice injury types were as follows: strains/sprains (39%), concussions (23%), other (21%), contusions (9%), and fractures (8%). Competition injury types were as follows: strains/sprains (34%), concussions (27%), other (17%), contusions (11%), and fractures (11%). Twenty-five percent of injuries occurred during the preseason, 70% of injuries occurred during the regular season, and 5% of injuries occurred during the postseason. Competition injuries for positions were as follows: linebacker (42%), running back (18%), other (15%), defensive tackle (9%), wide receiver (8%), and off guard (8%). Practice injuries were similar, with slightly higher wide receiver injury rates and slightly lower linebacker injury rates. Overall, injuries most often occurred with being tackled (26.3%), tackling (24.1%), blocking (15%), and being blocked (8.8%). Concussions most frequently occurred with being tackled (35.4%) and tackling (31.7%). The incidence rate for games was 3.23 concussions per 1,000

athletic exposures and the incidence rate for practices was .474 concussions per 1,000 athletic exposures (Center for Injury Research and Policy, 2015).

The latter data represent and an increase from the data obtained during the 2005 football season, which indicated a practice incidence rate of 0.21 concussions per 1,000 athletic exposures and a game incidence rate of 1.55 concussions per 1,000 athletic exposures (Gessel et al., 2007). The most common symptoms reported were headache (40.1%), dizziness (15.3%), confusion (8.6%), amnesia (6.9%), and loss of consciousness (3.9%) (Gessel et al., 2007).

A study conducted over the 2012-2013 high school football season found a comparable concussion incidence rate of 0.66 for practices and 2.01 for games (Dompier et al., 2015). Data were obtained from the National Athletic Treatment, Injury, and Outcomes Network (NATION) program which included 96 high school football teams (Dompier et al., 2015). The concussion incidence rate was very similar to data collected using the Athletic Injury Monitoring System. During the 1997-1998 football season, the Athletic Injury Monitoring System recorded a concussion incidence rate of .29 concussions per 1,000 athletic exposures for practices and 2.59 concussions per 1,000 athletic exposures for games (Zemper, 2003). Concussions were most likely to occur while being tackled (28%), tackling (21.97%), and blocking (20.15%) (Zemper, 2003). Based on the averages from the two seasons and approximate number of high school football players, the single season risk for an individual athlete to sustain a concussion was 1 out of 14 athletes each season (Dompier et al., 2015).

Concussion policies and practices may vary among schools, school districts, and states. Most schools have a concussion policy statement that must be signed prior to the

beginning of each season. However, due to funding restrictions, some schools cannot afford an onsite athletic trainer or medical staff to diagnose and treat concussions. In response to a growing need for education among coaches and others involved in youth sports, the CDC has an online course titled HEADS UP that covers concussions including the signs and symptoms, and how to respond to a potential concussion (CDC, 2015).

Collegiate

According to the National Collegiate Athletic Association Injury Surveillance System, from 2004 to 2009, the overall injury rate for football players was 8.1 injuries per 1,000 athletic exposures (National Collegiate Athletic Association [NCAA], 2014). Moreover, injuries occurred 7 times more in games than during practice. Combined injury percentages for football practices and competitions were as follows: lower limb (50.4%), upper limb (16.9%), torso and pelvis, (11.9%), other (9.1%), concussion (7.4%), and head, face, and neck (4.3%) Injuries by specific position were as follows: linebackers (13.5%), running backs (11%), wide receivers (11%), and quarterbacks (5.8%). Concussions accounted for 7.4% of all football injuries and were more likely to occur to the defense during run plays (17.8%) and offense during passing plays (16.3%). Data from the 2012-2013 National Collegiate Athletic Association Injury Surveillance System showed a practice concussion incidence rate of .53 concussions per 1,000 athletic exposures and a game incidence rate of 3.74 concussions per 1,000 athletic exposures (NCAA, 2013).

Concussion rates were similar to the data obtained from the 2005-2006 surveillance system, which reported an incidence rate of 0.39 concussions per 1,000 athletic exposures for practices and 3.02 concussions per 1,000 athletic exposures for

games (Gessel et al., 2007). Data collected using the Athletic Injury Monitoring System during the 1997-1998 football season also indicated a similar concussion incidence rate of .35 concussions per 1,000 athletic exposures for practices and 3.55 concussions per 1,000 athletic exposures for games (Zemper, 2003). Concussions were most likely to occur while tackling (25.16%), blocking (22.36%), and being tackled (22.36%) (Zemper, 2003). Based on the averages from the two seasons and approximate number of collegiate football players, the single season risk for an individual athlete to sustain a concussion was 1 out of 20 athletes each season (Dompier et al., 2015).

To address the concussion crisis, the NCAA continually is adapting their concussion policies and playing rules. For example, each institution is required to maintain and publicly display a concussion management plan. In 2010, the NCAA mandated that injured players be removed from play and assessed by medical staff prior to returning to the game. The horse collar tackle (i.e., defender tackles another player by grabbing the back collar or the back-inside of the opponent's shoulder pads) also is illegal, along with chop blocking (i.e., blocking at the thigh level or lower while the defender already is engaged by another offensive player). The league also is focusing on protecting defenseless players and preventing unnecessary blows to the head (NCAA, 2009).

Professional

The National Football League (NFL) has collected injury data on players since 1980. The NFL Injury Surveillance System is a tool utilized by team trainers to collect injury data and information related to injuries such as player time loss, player position, player activity, and team activity at the time of injury. The data reflect injuries that have

occurred during preseason, regular season, and playoff games. During a five-year period from 2002 to 2007, 758 fully-documented concussions were reported during 3,826 team games--an injury rate of .19 per team game (Casson, 2010). Fifty-seven (7.5%) of the concussions resulted in loss of consciousness (Casson, 2010). The defensive secondary was most likely to obtain a concussion (19.5%) followed by the special teams kick unit (13.9%), wide receivers (9.6%), running backs (9.1%), and linebackers (9.6%) (Casson, 2010). Concussions most frequently occurred while tackling (26.4%) and being tackled (26%) (Casson, 2010). Initial signs and symptoms reported by concussed players included headache (55.1%), dizziness (40.6%), information-processing problems (20.2%), difficulty with immediate recall (18.3%) and blurred vision (17.5%) (Casson, 2010). Following the diagnosis of a concussion, 8.4% of players returned to the game immediately, 38.1% rested and returned to the game, 50.7% were removed from the game, and 2.8% were hospitalized (Casson, 2010).

The NFL's Head, Neck, and Spine Committee has a protocol regarding the diagnosis and management of concussions. This protocol provides recommendations for the diagnosis and management of a concussion and includes return-to-play guidelines. In 2010, the NFL expanded its rules to prevent defenseless players from taking hits above the shoulders. Moreover, NFL spotters have been located in the press box since 2015 and have had the authority to stop the game when they spot a player showing concussion-like symptoms.

Female

Currently, there are no available data related to concussions sustained in women's football. There are limited studies that compare differences in concussion rates according

to gender, but it is not certain if these rates would be consistent if tested in the sport of football. A cohort study of collegiate athletes using the National Collegiate Athletic Association Injury Surveillance System was conducted on collegiate athletes participating in men's and women's soccer, lacrosse, basketball, softball, baseball, and gymnastics. Of 14,591 reported injuries, 5.9% were classified as concussions. During the 3-year study, female athletes sustained 167 (3.6%) concussions during practices and 304 (9.5%) concussions during games, compared with male athletes who sustained 148 (5.2%) concussions during practices and 254 (6.4%) concussions during games. Furthermore, female athletes sustained a higher percentage of concussions during games than male athletes (Covassin, Swanik, & Sachs, 2003). Another study was conducted at 100 high schools and 180 colleges in the United States. The study results showed that in high school sports played by both sexes, girls sustained a higher rate of concussions than boys, and concussions represented a greater proportion of total injuries for girls (Gessel, Fields, Collins, Dick, & Comstock, 2007).

Conclusion

Football impacts the lives of over 5 million athletes annually (Wong, Wong, & Bailes, 2014). Concussions are a frequent occurrence in football among all age categories even though there are emerging policies and practices to prevent concussions. Athletes in all age categories are more likely to sustain a concussion during games as opposed to practices. Female football players are on the rise and there are no data specific to concussions in female football players. Given the long-term implications of concussions, the need exists for more research on the topic.

CHAPTER III

METHODS AND PROCEDURES

Introduction

This study followed a retrospective descriptive design. As a result of the lack of literature on concussions related to women's professional football, a descriptive approach was justified to gather preliminary data to fully understand the scope of the issue prior to conducting an analytic study. In alignment with best practices for descriptive studies in social and behavioral sciences, research questions were developed instead of hypotheses. Due to the limited timeframe of the study protocol and lack of a concussion database, a retrospective study design was employed. This chapter will explain the processes of survey development, subject selection, and data collection and analysis that were used to conduct this study.

Survey Development

While numerous research studies have been conducted to measure the prevalence of concussions, most have been prospective in nature, or have utilized secondary data from national databases. Furthermore, most retrospective studies that have focused on self-reported concussions have not distinguished between medically and non-medically diagnosed concussions. Other retrospective studies have relied on secondary data provided by team athletic trainers or records from coaching staff. The options listed above were not available for the sample population; therefore, it was determined that a

survey should be developed to collect novel data for this research. The survey questions aligned with the study's research questions and previous literature.

The instrument underwent a content validation process based on the suggestions of Cottrell and McKenzie (2005). After the initial survey draft was assessed for face validity by the thesis committee, it then was reviewed for content validity by six additional experts in the fields of public health, epidemiology, women's football, and athletic training. See Appendix A for expert panel directions and a draft of the survey. Panelists rated each question on a scale of one (not acceptable) to five (indispensable). Experts were encouraged to provide feedback on each question as necessary. The scores for each question were summed and averaged. As recommended by Gilmore (1974), if a question did not have an average rating of 3 or higher, it was removed or re-formulated according to the experts' feedback. All survey questions received an average rating of 3.5 to 5.0. Based on feedback from the expert panel, five survey questions were added to differentiate between medically and non-medically diagnosed concussions. Specifically, two survey questions were added to assess concussions sustained during games or practices, two survey questions were added to determine the specific positions played when the concussions were sustained, and one question was added to determine the return-to-play time following concussions. The final survey was approved by the University of Wisconsin-La Crosse (UWL) Institutional Review Board (Appendix B). The full survey, consisting of seventeen closed-ended questions, can be found in Appendix C. Three questions related to the participants' demographic information and fourteen questions related to the number and type of concussion(s) sustained during the 2016 WFA football season.

The survey was transcribed into Qualtrics, an online data collection tool available to UWL students and faculty. Qualtrics allows for the collection of data in a secure database to assure confidentiality. The first page of the survey included an informed consent (Appendix D).

Subject Selection

Participants for this study were football players on teams belonging to the WFA. Forty-three teams were registered with the alliance for the 2016 season. According to the WFA individual team websites, teams averaged 36 players. Rosters on each team ranged from 19 to 71 athletes. Not all teams listed roster data, so the league average was used when team roster data were not available. The league roster totaled 1,549 athletes. This study utilized a convenience sample of players from the 2016 football season. An attempt was made to gather data from all players on the 43 teams.

Since individual player contact information was not directly available, at the request of the researcher, the WFA league owner e-mailed the concussion survey to all team representatives. In this communication prepared by the researcher, the study was briefly explained and team representatives were asked to forward the survey link and informed consent form to athletes who were active during the 2016 football season. In addition, the researcher encouraged participation by sending two reminder e-mails to all team owners who had an e-mail address listed on their respective websites ($n = 30$), two Facebook posts to all teams who allowed public posting on their respective Facebook pages ($n = 25$), and one call to each of the team owners that had a phone number listed on their respective websites ($n = 29$). Both the reminder e-mails and Facebook messages included the survey link and informed consent. Data were collected from February 24th,

2017 to April 15th, 2017. In the informed consent document included as the first page of the survey, participants were told that their participation was voluntary and that they could withdraw from participation at any time. They also were informed of the purpose of the study as well as benefits of their participation. Participants completed the online survey at a location where they had Internet access.

Statistical Analyses

The survey questions (Appendix C) were created to explore the incidence of concussions in women's professional football during the 2016 WFA season. sTable 2.1 depicts the six research questions (RQs) and the specific survey questions they were aligned with for this study. The dataset was downloaded from Qualtrics and transferred into the Statistical Package for the Social Sciences (SPSS), Version 23.

Table 1. Research Question Alignment with Survey Questions and Statistical Analyses

Research Question (RQ)	**Survey Question(s)**	**Statistical Analyses**
RQ1: What was the prevalence of concussions [by diagnosis] among WFA athletes for the 2016 football season?	5. As a result of football, how many medically-diagnosed concussions (i.e., diagnosed by an athletic trainer, medical professional, or coach trained on concussions) did you sustain during the 2016 football season? 6. As a result of football, how many non-medically diagnosed concussions (i.e., diagnosed by yourself, another player, a coach not trained on concussions, etc.) did you sustain during the 2016 football season?	Frequencies and percentages

RQ2: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices for the 2016 football season?	8. How many of your medically-diagnosed concussions occurred during football practices during the 2016 football season? 9. How many of your non-medically diagnosed concussions occurred during football practices during the 2016 football season? 10. Which position(s) were you playing during football practices when your medically-diagnosed concussion(s) occurred? 11. Which position(s) were you playing during football practices when your non-medically diagnosed concussion(s) occurred?	Frequencies and percentages
RQ3: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during games for the 2016 football season?	12. How many of your medically-diagnosed concussions occurred during football games during the 2016 football season? 13. How many of your non-medically diagnosed concussions occurred during football games during the 2016 football season? 14. Which position(s) were you playing during football games when your medically-diagnosed concussion(s) occurred? 15. Which position(s) were you playing during football games when your non-medically diagnosed concussion(s) occurred?	Frequencies and percentages

RQ4: What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices and games combined for the 2016 football season?	8. How many of your medically-diagnosed concussions occurred during football practices during the 2016 football season? 9. How many of your non-medically diagnosed concussions occurred during football practices during the 2016 football season? 10. Which position(s) were you playing during football practices when your medically-diagnosed concussion(s) occurred? 11. Which position(s) were you playing during football practices when your non-medically diagnosed concussion(s) occurred? 12. How many of your medically-diagnosed concussions occurred during football games during the 2016 football season? 13. How many of your non-medically diagnosed concussions occurred during football games during the 2016 football season? 14. Which position(s) were you playing during football games when your medically-diagnosed concussion(s) occurred? 15. Which position(s) were you playing during football games when your non-medically diagnosed concussion(s) occurred?	Frequencies and percentages

RQ5: What percentage of non-medically diagnosed concussions that WFA athletes sustained during the 2016 football season were NOT reported during the 2016 football season?	7. How many non-medically diagnosed concussions as a result of football-related activities that you sustained during the 2016 football season were **NOT reported** to a coach, athletic trainer, or medical professional?	Frequencies and percentages
RQ6: What was the average return-to-play time post-concussion for WFA athletes during the 2016 football season?	16. Following your medically diagnosed concussion(s) during the 2016 football season, how soon did you return-to-play? 17. Following your non-medically diagnosed concussion(s) during the 2016 football season, how soon did you return-to-play?	Frequencies and percentages

The investigator initially examined the dataset by identifying missing data. Surveys that were incomplete were removed ($n = 7$). Responses from athletes who did not play in 2016 or did not play for a WFA team in 2016 were removed ($n = 12$).

For survey questions five through seventeen, the results were split based on responses to previous survey questions to improve the validity of the data. Surveys questions five and six were split based on the responses to question number four. In this case, splitting the data file ensured that only cases that indicated a concussion in question four were included in questions five (number of medically-diagnosed concussion) and six (number of non-medically diagnosed concussions).

Survey question seven (non-medically diagnosed concussion reporting) was split based on the responses to survey question five. In this case, splitting the file data ensured that only cases that indicated a non-medically diagnosed concussion were included in question seven.

Survey questions eight (medically-diagnosed concussions in practices), twelve (medically-diagnosed concussions during games), and sixteen (return-to-play timeline for medically-diagnosed concussions) only included cases that reported sustaining a medically diagnosed concussion in question five.

Survey questions nine (non-medically diagnosed concussions in practices), thirteen (non-medically diagnosed concussions during games), and seventeen (return-to-play timeline for non-medically diagnosed concussions) only included cases that reported sustaining at least one non-medically diagnosed concussion in question six.

Survey question ten only included cases that indicated sustaining at least one medically-diagnosed concussion during football practices in survey question eight. Survey question 11 only included cases that indicated sustaining at least one non-medically diagnosed concussion during football practices in survey question nine. Survey question 14 only included cases that indicated sustaining at least one medically-diagnosed concussion during football games in survey question 12. Survey question 15 only included cases that indicated sustaining at least one non-medically diagnosed concussion during football games in survey question 13.

After splitting the data, responses from four athletes who indicated a concussion were removed due to validity. Responses were considered invalid if subsequent answers in the survey were not representative of how many concussion occurrences were indicated earlier in the survey.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The purpose of this investigation was to explore the prevalence of concussions in the Women's Football Alliance (WFA) during the 2016 season. Data were collected through electronic surveys distributed by the league owner from the Women's Football Alliance and the researcher. Both the league owner and researcher e-mailed the concussion survey to team representatives. The team representatives were asked to forward the survey link and informed consent form to athletes who were active during the 2016 football season. In addition, the researcher encouraged participation by posting two Facebook posts to all teams who allowed public posting on their respective Facebook pages and making one phone call to each of the team representatives that had a phone number listed on their respective websites. This research could lead to a better understanding of concussion prevalence among female football players, and could provide insights regarding the underreporting of concussions. This chapter will provide an overview of the findings of this research study in relation to the research questions in the results section. This chapter will also highlight key implications of the results in the discussion section.

Results

The electronic survey was available online from February 24th, 2017 to April 15th, 2017 to a maximum of 1,549 participants, if all teams forwarded the electronic survey to

their 2016 athletes. Based on the results, 13 out of the 43 teams forwarded the survey to their athletes, leaving a maximum response potential of 489 athletes. There were no responses from athletes from the remaining 30 teams, leading the researcher to assume the survey was not distributed from the team representatives to the athletes. The number of players who completed the survey was 89, resulting in a response rate of 18.2%. After removing data from respondents who did not answer all of the questions in the survey or who did not meet the study inclusion criteria (i.e., participation in the WFA league during the 2016 season), there were 67 complete records in the dataset.

Demographics of Survey Respondents

Participating athletes indicated that they played on one of the following WFA teams in 2016: Arlington Impact, Boston Renegades, Central Cal War Angels, Derby City Dynamite, Detroit Dark Angels, Kansas City Titans, Mile High Blaze, Pacific Warriors, South Oregon Lady Gades, Toledo Reign, Ventra Wolfpack, or West Michigan Mayhem. The athletes' ages ranged from 21 to 53 years old, with an average age of 31. The years of experience playing women's football varied greatly with athletes indicating anywhere from 1 to 19 years of experience. The average years of playing experience was four years. See Table 4.1 for a summary of participants' demographics.

Table 2. Demographic Information for Women's Football Alliance Survey Respondents, 2016 Football Season

N = 67		
Demographics	**Frequency**	**Percentage**
Age		
18-29	**30**	44.8%
30-39	**25**	37.3%
40-49	**11**	16.4%
50-59	**1**	1.5%
Years Played		
1	**23**	34.3%
2	**13**	19.4%
3	**8**	11.9%
4	**1**	1.5%
5	**3**	4.5%
6	**3**	4.5%
7	**5**	7.5%
8	**3**	4.5%
9	**2**	2.9%
10	**0**	0.0%
11+	**6**	9.0%

Prevalence of Concussions by Diagnosis

For RQ1 (i.e., What was the prevalence of concussions [by diagnosis] among WFA athletes for the 2016 football season?), eight of the 67 athletes (11.9%) indicated that they sustained a medically-diagnosed concussion (i.e., diagnosed by an athletic trainer, medical professional, or coach trained on concussions) or non-medically diagnosed concussion (i.e., diagnosed by themselves, another player, a coach not trained on concussions, etc.) as a result of playing football during the 2016 WFA football season. Out of the eight subjects who reported a concussion, four (50.0%) indicated sustaining one medically-diagnosed concussion and five (62.5%) indicated sustaining one non-medically diagnosed concussion during the 2016 football season as a result of playing football. As such, one athlete indicated sustaining both one medically-diagnosed concussion and one non-medically diagnosed concussion. The total number of identified concussions was nine. Four (44.4%) concussions were medically-diagnosed and five (55.5%) concussions were non-medically diagnosed. See Table 4.2 for a summary of medically-diagnosed and non-medically diagnosed concussions.

Table 3. Summary of Concussion(s) Sustained as a Result of Football-Related Activities, 2016 WFA Football Season

	Type of Diagnosis	Non-Medically Diagnosed Reported	Sustained During Practice Vs. Game	Position Played	Return-to-Play Timeline
Athlete 1	Medically-Diagnosed	N/A	Game	Offensive Line	7 Days
Athlete 2	Medically-Diagnosed	N/A	Game	Offensive Line	14 Days
Athlete 3	Medically-Diagnosed	N/A	Game	Linebacker	7 Days
Athlete 4	Medically-Diagnosed	N/A	Practice	Defensive Line	14 Days
Athlete 4	Non-Medically Diagnosed	Reported	Practice	Defensive Line	7 Days
Athlete 5	Non-Medically Diagnosed	Not-Reported	Game	Running Back	14 Days
Athlete 6	Non-Medically Diagnosed	Reported	Game	Defensive Line	Season Ended
Athlete 7	Non-Medically Diagnosed	Reported	Game	Offensive Line	72 Hours
Athlete 8	Non-Medically Diagnosed	Reported	Practice	Running Back	7 Days

Prevalence of Practice-Related Concussions by Diagnosis and Position

For RQ2 (i.e., What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices for the 2016 football season?), one out of the four (25.0%) medically-diagnosed concussions occurred during practice. The positions played when sustaining a medically-diagnosed concussion during practice was defensive line. Two out of five (40.0%) non-medically diagnosed concussions occurred during practice. The positions played when sustaining a non-medically diagnosed concussion during practice were defensive line and running back.

Prevalence of Game-Related Concussions by Diagnosis and Position

For RQ3 (i.e., What was the prevalence of concussions [by diagnosis and position] among WFA athletes during games for the 2016 football season?), three out of four (75.0%) medically-diagnosed concussions occurred during games. The positions played when sustaining a medically-diagnosed concussion during games were offensive line ($n = 2$) and linebacker ($n = 1$). Three out of five (60%) non-medically diagnosed concussions occurred during games. The positions played when sustaining a non-medically diagnosed concussion during games were running back, offensive line, and defensive line. See Tables 4.3 and 4.4 for a summary game and practice-related concussions by diagnosis.

Combined Prevalence of Game and Practice-Related Concussions by Diagnosis and Position

For RQ4 (i.e., What was the prevalence of concussions [by diagnosis and position] among WFA athletes during practices and games combined in the 2016 football season?), three out of nine (33.3%) concussions were sustained during practice and six out of nine (66.6%) concussions were sustained during games. The positions played when a concussion was sustained were: offensive line ($n = 3$), defensive line ($n = 3$), running back ($n = 2$), and linebacker ($n = 1$). See Table 4.3 for a summary of practice and game-related concussions by position.

Table 4. Non-Medically Diagnosed and Medically-Diagnosed Position Specific Practice and Game Concussions Sustained as a Result of Football-Related Activities, 2016 WFA Football Season

N = 9		
Position	**Frequency**	**Percentage**
Offensive Line	3	33.3%
Defensive Line	3	33.3%
Running Back	2	22.3%
Linebacker	1	11.1%

Concussions Not Reported

For RQ5 (i.e., What percentage of non-medically diagnosed concussions that WFA athletes sustained during the 2016 football season were NOT reported during the 2016 football season?), one out of five (20%) non-medically diagnosed concussions were not reported. Therefore, four out of the five athletes (80.0%) who indicated a non-medically diagnosed concussion reported the concussion.

Return-to-Play Time Post-Concussion

For RQ6 (i.e., What was the average return-to-play time post-concussion for WFA athletes during the 2016 football season?), the return-to-play time for athletes sustaining a medically-diagnosed concussion was as follows: returned to play within 72 hours (n = 1), returned to play within 7 days (n = 4), returned to play within 14 days (n = 3) and season ended (n = 1). See table 4.4 for a summary of return-to-play time post-concussion.

Table 5. Non-Medically Diagnosed and Medically-Diagnosed Return-to-Play Time Post-concussion, 2016 WFA Football Season

$N = 9$		
Return-to-Play Time	**Frequency**	**Percentage**
Within 72 Hours	1	11.1%
Within 7 Days	4	44.5%
Within 14 Days	3	33.3%
Season Ended	1	11.1%

Summary

In the WFA alone, there are over 1,500 athletes playing women's professional football across the United States. While this study only captured a fraction of those athletes, the results indicated that concussions occur in women's professional football. Nearly 12% of athletes reported sustaining at least one medically-diagnosed or non-medically diagnosed concussion during the 2016 WFA football season as a result of playing football. Specifically, four out of eight (50.0%) athletes reported sustaining one medically-diagnosed concussion and five out of eight (62.5%) athletes reported sustaining one non-medically diagnosed concussion. A total of nine concussions were reported. Twenty percent of non-medically diagnosed concussions were not reported to a coach, athletic trainer, or medical doctor.

Both medically-diagnosed and non-medically diagnosed concussions were more likely to occur during games than practices. Six out of the nine (66.6%) concussions occurred during games.

Linebacker, offensive line and defensive line were the positions played when a medically-diagnosed concussion occurred. Offensive line, defensive line, and running back were the positions played when a non-medically diagnosed concussion occurred. No concussions were reported for wide receivers, quarterbacks, special teams, and defensive backs.

The average return-to-play time post-concussion varied. One athlete reported returning to play with 72 hours of a concussion and four athletes reported returning to play within 7 days of a concussion.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Concussions are an emerging issue in public health. To date, all of the literature related to concussions and football has revolved around the male population. The results of this study indicate that concussions occur in women's professional football. This study laid the groundwork for future research related to concussion in women's professional football. This chapter will provide a summary of the research completed for this study and recommendations for future studies and public health practice.

Summary

Football is one of the most popular team sports in the United States and impacts the lives of over 5 million athletes annually (Wong, Wong, & Bailes, 2014). Athletes participate in football throughout developmental stages including youth, high school, collegiate, and professional. Football is increasing in popularity in the female population; however, injury data specific to females are unavailable.

Athletes who participate in contact sports such as football are at a greater risk for sustaining concussions (Zemper, 2003). There is increasing concern that concussions can lead to short- and long-term neurological complications. Repeat trauma to the head, including concussions, may lead to chronic traumatic encephalopathy (CTE). According to the CDC (2015), CTE is a progressive neurodegenerative disease that is caused by brain trauma, and is not limited to athletes who have reported concussions. In addition,

athletes who return to play before their concussion is healed are at risk for second impact syndrome. Second impact syndrome is an acute, often fatal brain swelling condition that occurs when an athlete sustains a second concussion prior to fully recovering from the initial concussion (American Association of Neurological Surgeons, 2017).

The purpose of this retrospective descriptive study was to explore concussions in the Women's Football Alliance (WFA) during the 2016 football season and categorize concussions based on type, athletic exposure, and position played. The WFA is a women's professional football league located in the United States and was established in 2007. The WFA is a full-tackle women's football league and athletes must be at least 18 years of age to play in the league.

This study utilized a convenience sample of players from the 2016 WFA season. Data were collected through electronic surveys distributed by the WFA league owner, researcher, and team representatives. The survey link also was posted on Facebook and may not have been viewed by all players on each team. Players from 13 of the 43 teams in the league participated in this study. The participating teams' rosters totaled 489 athletes; however, the number of actual participants for this study ($n = 67$) was much lower.

Conclusion

Nearly 12% of athletes who responded to the survey indicated sustaining at least one concussion during the 2016 WFA football season. Based on the averages and approximate number of youth, high school, and collegiate male football players, the risk for an individual athlete to sustain a concussion during a season is 1 out of 30 (3%), 1 out of 14 (7%), and 1 out of 20 (5%), respectively (Dompier et al., 2015). As determined by

the results of this exploratory study, females are indicating higher rates of concussions as a result of playing football when compared to their male counterparts. This finding is similar to previous literature which suggests that within comparable sports (e.g., soccer and basketball), there is a higher concussion incidence rate among female athletes (Gessel, Fields, Collins, Dick, & Comstock, 2007). Similar to the male population, concussions in women's professional football are more likely to occur during games than practices as determined by the results of this study (Center for Injury Research and Policy, 2015; Dompier et al., 2015).

In this study, only one out of five athletes who sustained a non-medically diagnosed concussion failed to report the concussion to a coach, athletic trainer, or medical doctor. This finding is lower than a 2004 study of high school football players indicating that 53% of concussions are not reported (McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004). According to a study performed by Brown and colleagues (2015), females were 43% more likely to report concussion symptoms than males. However, females are still likely to underreport concussions. For example, a 2016 study of 77 high school female athletes revealed that 32% of athletes refrained from reporting a suspected concussion (McDonald, Burghart, & Nazir, 2016).

One athlete returned to play within 72 hours after a concussion was non-medically diagnosed and 4 athletes returned to play within seven days following a concussion diagnosis. Among the cases returning to play within seven days, two of the concussions were medically-diagnosed and two of the concussions were non-medically diagnosed. This is concerning as athletes who sustain a concussion are at risk for second impact syndrome, an acute, often fatal brain swelling condition that occurs when an athlete

sustains a second concussion prior to fully recovering from the initial concussion (American Association of Neurological Surgeons, 2017). WFA team rosters vary in size from 19 to 71 athletes, so athletes may feel pressured by teammates and coaches to return to play before they are fully recovered. In addition, the WFA football season is very short and athletes do not want to miss their opportunity to play.

Discussion

This study has led to a better understanding of concussions in women's professional football. Women's professional football continues to increase in popularity both in the number of athletes and number of teams throughout the nation. Players from 13 of the 43 teams in the league participated in this study. The lower sample size could be related to willful blindness (i.e., a phenomenon whereby an issue exists that people could and should be aware of, but choose not to be aware), apathy, or a lack of interest in the topic of concussions among team representatives and/or players. Lower than anticipated participation could have resulted from incomplete or inaccurate e-mail contact lists from the league and researcher to the team representatives and from the team representatives to the players. There often is a lot of turnover of players, owners, and coaches in women's professional football. Moreover, it is uncertain as to whether team representatives encouraged or reminded their athletes to participate in the research study. It should be noted that the study started during the 2017 football season. As such, team representatives may not have maintained accurate contact information from players who participated in 2016, but decided not to participate in the 2017 football season. Players also were preparing for the 2017 football season and may have disregarded the survey completely.

As determined by the results of this exploratory study, nearly 12% of female football players indicated sustaining at least one concussion during the 2016 WFA football season. Based on the literature review, females are indicating higher rates of concussions as a result of playing football when compared to their male counterparts. However, due to the sampling method and sampling size of this study, the results are not generalizable to the entire WFA football league.

The positions played when a concussion was sustained were: offensive line (n = 3), defensive line (n = 3), running back (n = 2), and linebacker (n = 1). Based on the positions played when the concussions occurred, it would appear that most concussions are occurring near or around the line of scrimmage. This is indicative of how most women's football games are played. Due to the lack of experience and preparation time, a majority of teams focus on running the football or executing plays that involve a short distance; this could result in more activity near or around the line of scrimmage.

There currently is a lack of football gear specific to meeting the needs of the female population. For example, only one company (i.e., Douglass) makes a shoulder pad specific to females. Moreover, there are no helmets or any other gear designed to meet the smaller frame and size of most female athletes. With the growth in the number of athletes and prevalence of concussions, this study may lead to an increase in both the demand and need for women's-specific football gear.

In addition to the lack of women's-specific football gear, the WFA does not have a concussion protocol and does not require teams to have athletic trainers on staff. Unfortunately, teams often are on a tight budget and rely on volunteers or community partnerships for their athletic trainers. Currently, it is the responsibility of individual

teams to determine when an athlete can return to play. Moreover, athletes are not required to obtain medical clearance after a concussion is diagnosed or suspected. There also are no limits to the number of practices per season and the amount of contact allowed at each practice. These issues need to be addressed in light of findings from this study.

Recommendations

After reviewing the survey results, there are many recommendations that could be made for future studies and public health practice. Particularly, increasing the sample size and changing the sampling method would allow for representation from a wider variety of teams and might yield results that would be generalizable to the entire league. Only 13 out of the 43 teams had athletes that participated in the survey. In addition, an improved rapport with the league and team owners or using a Community Based Participatory Research approach may increase the odds of greater participation among athletes. Furthermore, sending the survey directly to the WFA registered athletes, instead of sending the survey through the team owners would eliminate a potential barrier to athletes obtaining the survey.

Given the possibility of recall bias among the athletes, a prospective study design with systematic cluster sampling and sub-sampling, would have a greater potential to yield accurate data. Based on a review of the literature, most concussion studies have been prospective in nature or have utilized existing injury databases; however, the limited timeframe and resources of the researcher did not allow for this type of investigation. In terms of a prospective study design, partnering with individual team owners or athletic trainers prior to the start of a season would be worth consideration. Team owners or athletic trainers could record concussion data immediately following diagnoses.

Currently, the WFA does not mandate individual team injury reporting. Considering the prevalence of non-medically diagnosed concussions, implementing a stricter detection protocol and a standardized injury reporting database would be another method to obtain consistent and accurate injury data.

Based on the inconsistencies in the data for athletes reporting multiple concussions in this study, the survey tool itself could be modified. Based on a subject by subject review of the data, some athletes indicated sustaining only one concussion, but indicated the concussion occurred both during a practice and during a game. In addition, some athletes reported sustaining multiple concussions, but failed to indicate when they occurred. Having athletes report on each concussion, as opposed to reporting on total concussions sustained may have yielded more consistent results. Also, if a concussion occurred during practice, it was assumed the concussion occurred while the athlete was playing a specific position instead of participating in a specific drill. As such, adding a response such as "occurred during a drill" might be a better reflection of concussion occurrences. Furthermore, the concussions themselves may have impacted the athletes' memory. Common signs of a concussion may include athletes that appear dazed or stunned, seem confused about their assignment or forget instruction, answer questions slowly, lose consciousness, and cannot recall events prior to or after the event (CDC, 2015).

While having athletes indicate "medically" versus "non-medically" diagnosed concussions added additional questions and may have confused athletes, this information is vital to understanding the nature of concussions. Women's professional football teams are not required to have an athletic trainer onsite for games or practices so concussions

are not always medically-diagnosed. Moreover, coaches are not required to obtain any type of certification in concussion recognition. Collecting non-medically diagnosed concussion data leads to a further understanding of concussion underreporting.

Athletes' reporting of concussion symptoms is integral to concussion risk reduction. The theory of Planned Behavior could be used in prediction of concussive symptom underreporting. According to the Theory of Planned Behavior, the most important predictor of a specific behavior is the intention to perform that behavior. Intention can be directly predicted by three factors: attitude toward performing the behavior, subjective norms, and perceived behavioral control.

In addition to investigating the underreporting of concussions in women's football, return-to-play time should be explored in terms of the type of concussion diagnosis. For example, do athletes return to play sooner if their concussion was not medically-diagnosed?

Individual teams should be required to conduct baseline concussion testing on athletes prior to the start of every season. These computerized exams are a snapshot of how the healthy brain functions; they also serve as a reference point. If an athlete is suspected of sustaining a concussion, the test is repeated and compared to the baseline results (Cantu & Hyman, 2013). This critical information then can be used by physicians to help treat the injury and prevent premature return to play.

Based on the results of this study, one athlete returned to play within 72 hours following a concussion diagnosis and four athletes returned to play within one week of a concussion diagnosis. According to leading concussion researchers, athletes may be returning to play too soon. As noted by Cantu and Hyman (2013), "Most concussions

resolve in seven to ten days and athletes return to their normal activities in two weeks" (p. 71). Athletes returning to play before their brain is healed are at risk for second impact syndrome. Athletes returning to play before their brain is healed are at risk for second impact syndrome. This life-threatening injury occurs when an athlete suffers a second head injury before the previous head injury was healed (American Association of Neurological Surgeons, 2017). The league should require all teams to implement return-to-play guidelines. Athletes should be required to obtain medical clearance prior to returning to play if a concussion was diagnosed or suspected. Moreover, there also is a need for standardized surveillance of concussion-related data.

Additional research is needed to investigate head injuries sustained as a result of playing women's professional football. Future studies should attempt to increase sample sizes and change the sampling method in order to incorporate a wider variety of teams from various women's professional football leagues. Studies should be focused on concussion reporting and the prevalence of underreporting. Research should include education about the risks of concussion and the dangers of returning to play too soon. Furthermore, studies should center on the impact of using proper equipment and gear fitting related to concussion and injury prevention.

Public health professionals should be serving as a resource and a voice for concussion prevention. There currently is a lack of public health engagement in preventing sport-related concussions and subsequent injuries. As such, public health professionals should: develop and disseminate model concussion protocols, collaborate with health care providers to develop and provide trainings on concussion identification, conduct outreach to area sports organizations, and become members of statewide teams

to evaluate the effectiveness of concussion laws and policies. Specific to the game of football, public health professionals should encourage teams to practices without tackling or limit the number of full-contact practices, educate coaches, players and trainers about concussions and the importance of reporting them, teach safer techniques for playing the game, and assist with fitting players for the correct gear.

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APPENDIX A

DRAFT SURVEY FOR REVIEW PANEL

Notes for Review Panel:

Dear content validity reviewer,

My name is Tiffany Lein and I am a student in the Master of Public Health in Community Health Education program at the University of Wisconsin-La Crosse. I am in the process of preparing a survey for my graduate thesis and would appreciate your assistance in reviewing the survey for content validity. The purpose of content validity is to determine if the items (or questions) in an instrument measure what they are intended to measure. This is done by collecting the feedback of experts. You have been selected to review the survey because you are an expert in health research, public health, athletic training, or have personal or professional experience with women's professional football.

The survey will be administered to Women's Football Alliance (WFA) women's professional football athletes who played during the 2016 football season. The purposes of the survey are to: (a) determine the prevalence of concussions [by position] among WFA athletes during practices and games in the 2016 football season, (b) determine the percentage of concussions that WFA athletes sustained that went unreported during the 2016 football season, and (c) determine the average return-to-play time post-concussion for WFA athletes during the 2016 football season. The gathered data ultimately may be used to guide player safety recommendations and concussion-based education for players and coaching staff.

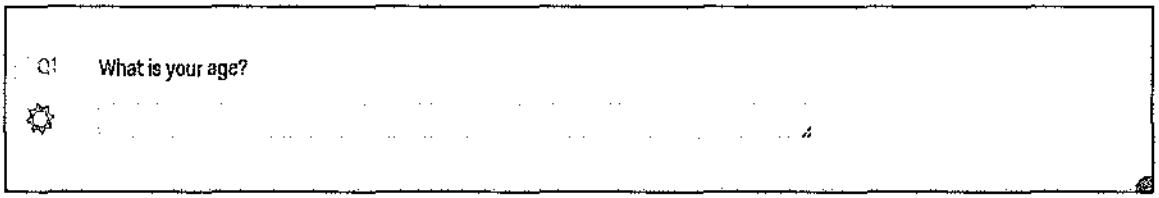
Please be mindful of the following information when completing the content validity assessment:

1. All survey items (attached) are contained within an outlined text box. The content in each text box is intended for the WFA athletes to review and respond to. The text below the outlined boxes are questions pertaining to content validity, and should be answered by you, the reviewer.
2. For each item in the survey, there is a 1-5 scale for ranking the ability of the item to measure what it is intended to measure. There also is a space for you to leave comments. Please indicate a number 1 (not at all effective) to 5 (very effective), for each survey item, and offer any comments you have. Your feedback is valued and appreciated.
3. If you have any questions, please contact me at lein.tiff@uwlax.edu or 608-518-7046.
4. If possible, please complete and submit your review to me via email by 5 pm on Friday, December 23rd. Thank you again for your expertise and assistance.

T. Lein

Tiffany Lein

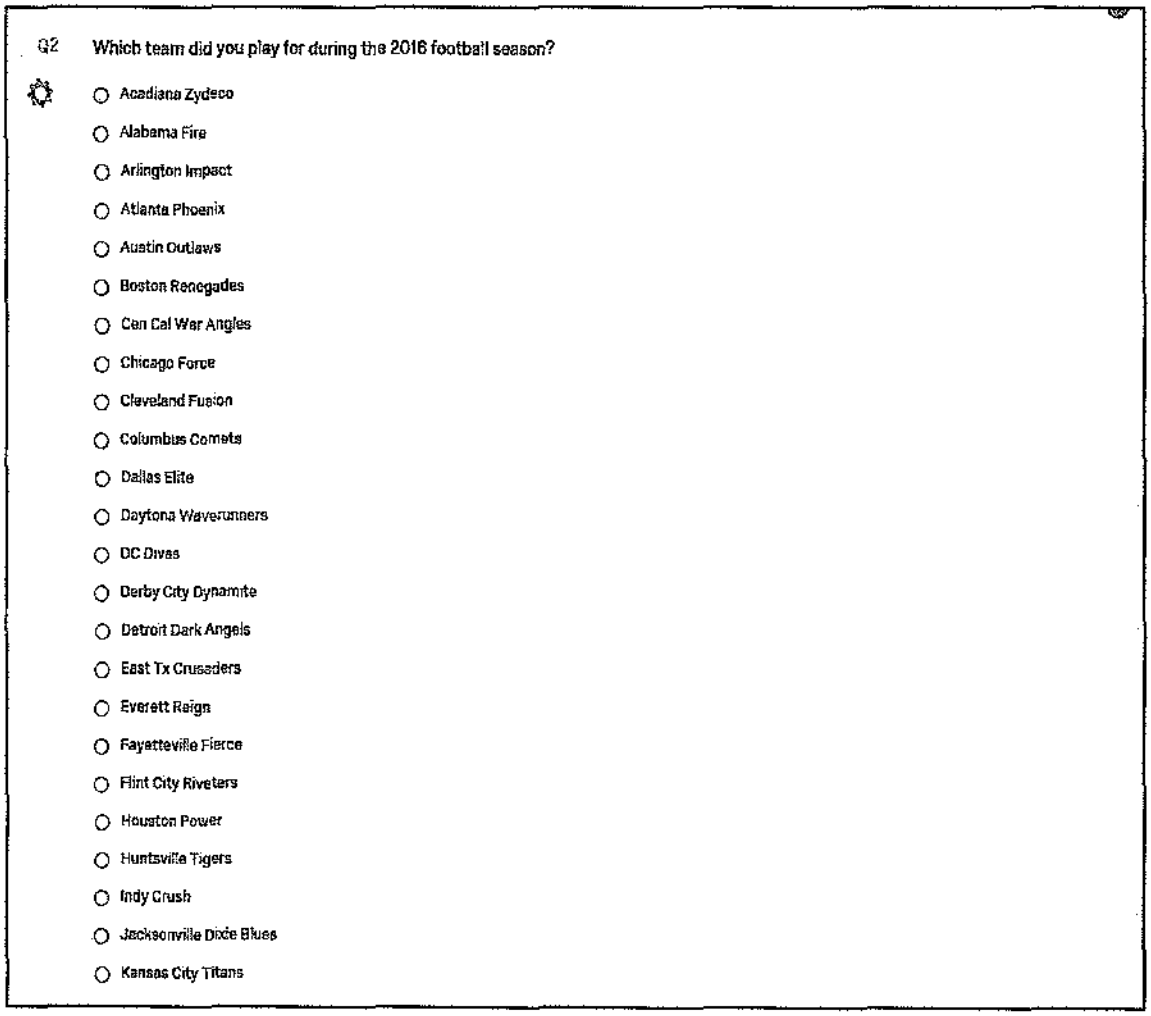
Survey

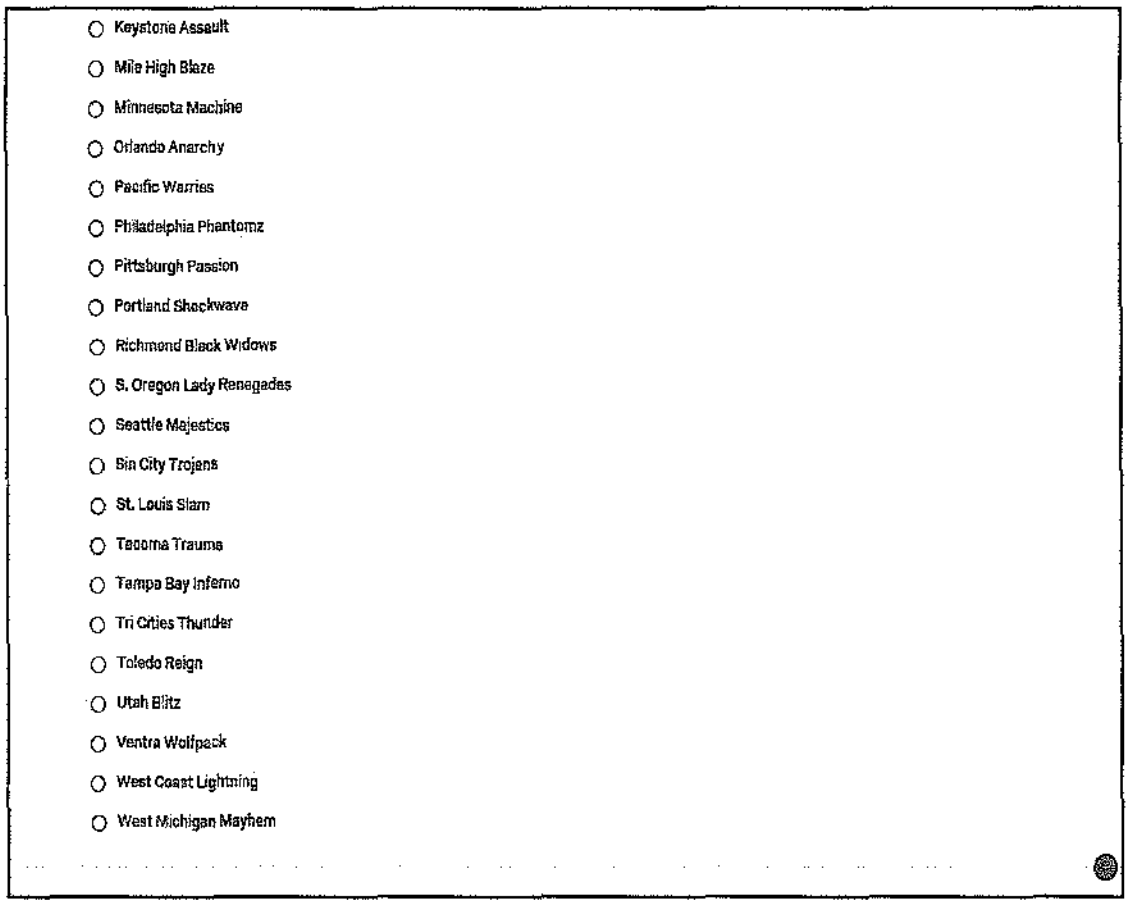


Please rate the effectiveness of this item to determine the average age of WFA players:

Not at all effective				Very effective
1	2	3	4	5

Comments:

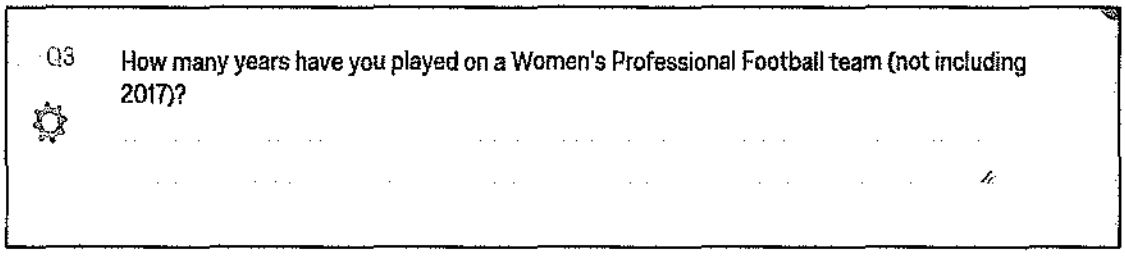




Please rate the effectiveness of this item to determine the team for which the WFA athletes played during the 2016 football season:

Not at all effective				Very effective
1	2	3	4	5

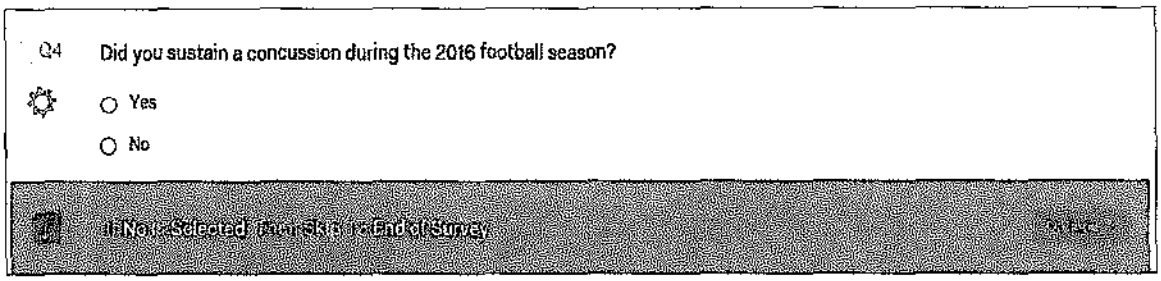
Comments:



Please rate the effectiveness of this item to determine the average number of years athletes have played for ANY women's professional football team:

Not at all effective Very effective
1 2 3 4 5

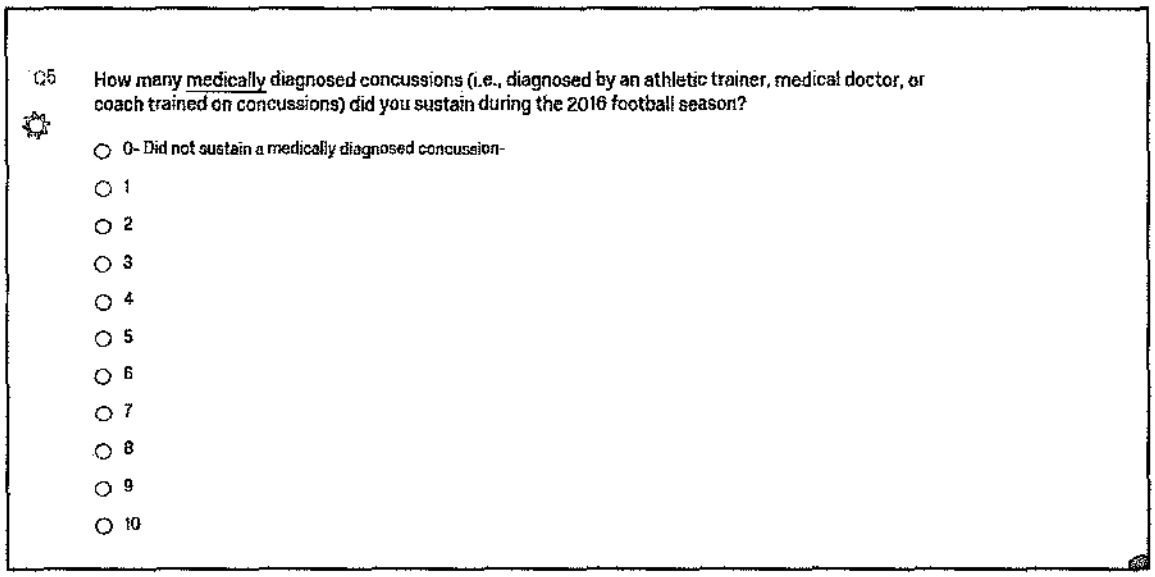
Comments:



Please rate the effectiveness of this item to determine whether or not WFA athletes sustained a concussion during the 2016 football season:

Not at all effective Very effective
1 2 3 4 5

Comments:



Please rate the effectiveness of this item to determine the total number of medically-diagnosed concussions WFA athletes sustained during the 2016 football season:

Not at all effective Very effective
1 2 3 4 5

Comments:

Use the following definition of a concussion to answer the question below. Definition of a concussion: A concussion a condition resulting from the stunning, damaging, or shattering effects of a hard blow to the head followed by a variety of symptoms that may include any of the following: blurry vision, confusion, dizziness, feeling hazy, feeling very drowsy, headache, nausea, not feeling right and sensitivity to light or sound.

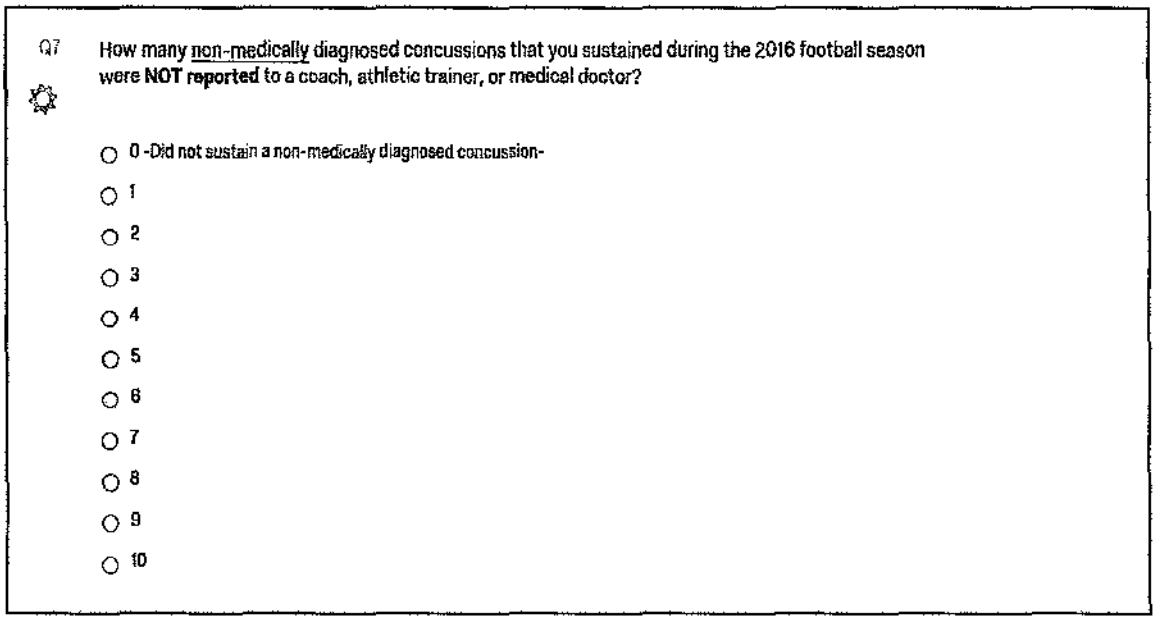
Based on the definition above, how many non-medically diagnosed concussion (i.e., diagnosed by yourself, another player, a coach not trained on concussions etc.) did you sustain during the 2016 football season?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10

Please rate the effectiveness of this item to determine the total number of non-medically diagnosed concussions WFA athletes sustained during the 2016 football season:

Not at all effective				Very effective
1	2	3	4	5

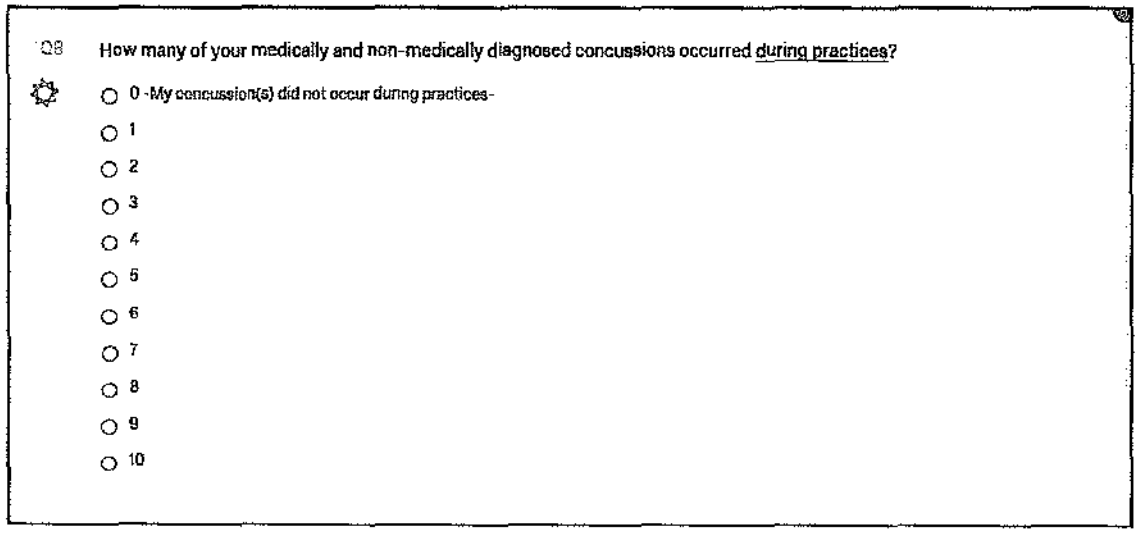
Comments:



Please rate the effectiveness of this item to determine the total number of non-medically diagnosed concussions WFA athletes sustained during the 2016 football season that were NOT reported:

Not at all effective				Very effective
1	2	3	4	5

Comments:



Please rate the effectiveness of this item to determine the total number of concussions WFA athletes sustained during practices for the 2016 football season:

Not at all effective				Very effective
1	2	3	4	5

Comments:

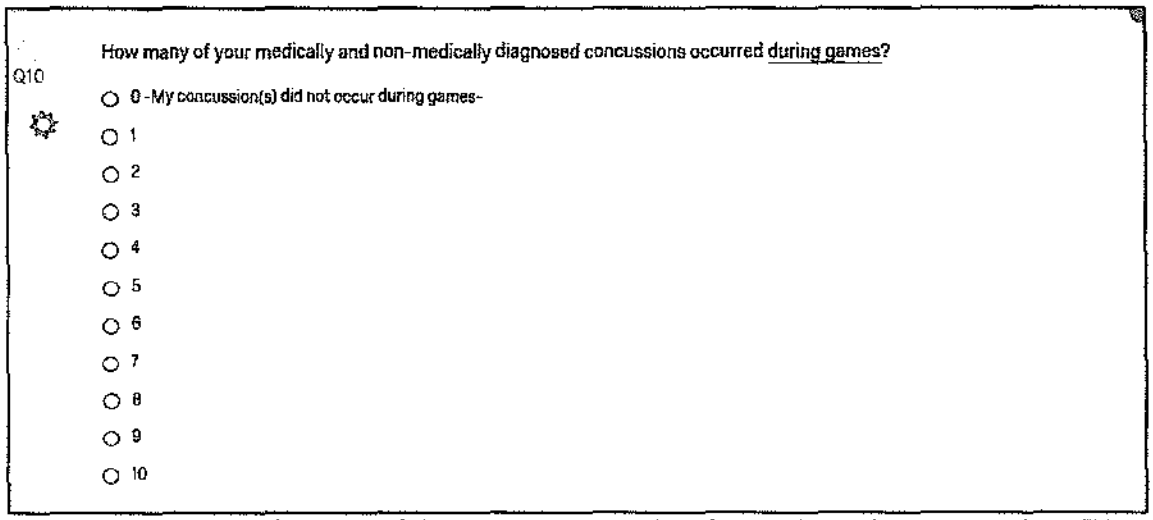
C9 Which position(s) were you playing during practices when your medically and non-medically diagnosed concussion(s) occurred? (Select all that apply.)

- ☐ My concussion(s) did not occur during practices
- ☐ Quarterback
- ☐ Running back (fullback, halfback)
- ☐ Wide receiver
- ☐ Offensive line (tackle, guard, center, tight end)
- ☐ Defensive back (cornerback, safety)
- ☐ Linebacker
- ☐ Defensive line (end, tackle)
- ☐ Special teams (kick or punt returner)
- ☐ Special teams (all positions EXCEPT kick or punter returner)

Please rate the effectiveness of this item to determine the position(s) WFA athletes were playing during practices when concussions were sustained:

Not at all effective				Very effective
1	2	3	4	5

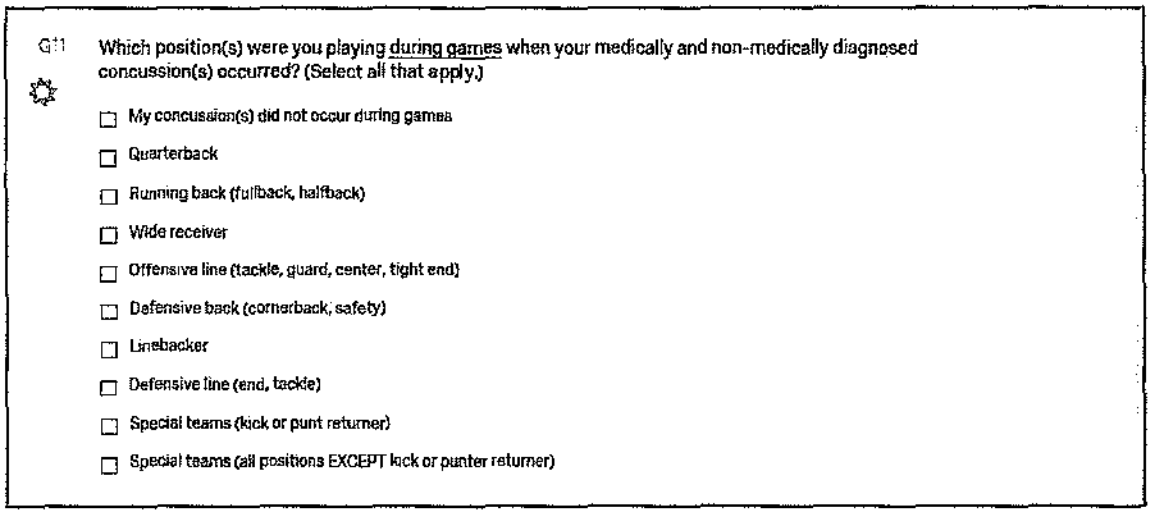
Comments:



Please rate the effectiveness of this item to determine the total number concussions WFA athletes sustained during games for the 2016 football season:

Not at all effective				Very effective
1	2	3	4	5

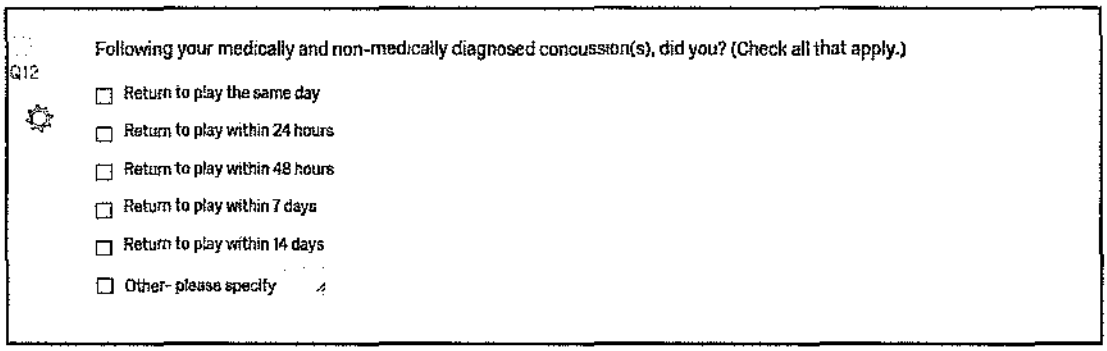
Comments:



Please rate the effectiveness of this item to determine the position(s) WFA athletes were playing during games when concussions were sustained:

Not at all effective				Very effective
1	2	3	4	5

Comments:



Please rate the effectiveness of this item in measuring the average return-to-play time post-concussion for WFA athletes during the 2016 football season:

Not at all effective				Very effective
1	2	3	4	5

Comments:

APPENDIX B

IRB APPROVAL

UNIVERSITY of WISCONSIN
LA CROSSE

To: Tiffany Lein

From: Bart Van Voorhis, Coordinator
Institutional Review Board (IRB) for the
Protection of Human Subjects
bvanvoorhis@uwlax.edu
608-785-6892

Date: February 20, 2017

Re: **RESEARCH PROTOCOL SUBMITTED TO IRB**

The IRB Committee has reviewed your proposed research project entitled: **"Concussion Prevalence and Reporting in Women's Professional Football."**

The Committee has determined that your research protocol will not place human subjects at risk. **The attached protocol has been approved and is exempt from further review per 45CFR46, 46.101(b)(2).**

However, it is strongly suggested that Informed Consent always be used. Remember to provide participants a copy of the consent form and to keep a copy for your records. Consent documentation and IRB records should be retained for at least 3 years after completion of the project.

Since you are not seeking federal funding for this research, the review process is complete and you may proceed with your project.
Good luck with your project!

Bart A. VanVoorhis

cc: IRB File
Michele Pettit, Faculty Advisor

APPENDIX C

FINAL SURVEY

Survey

Q1 What is your age?

Q2 How many years have you played on a Women's Professional Football team (not including 2017)?

Q3 Which WFA team did you play for during the 2016 football season?

- ○ Acadiana Zydeco (1)
- ○ Alabama Fire (2)
- ○ Arlington Impact (3)
- ○ Atlanta Phoenix (4)
- ○ Austin Outlaws (5)
- ○ Boston Renegades (6)
- ○ Cen Cal War Angels (7)
- ○ Chicago Force (8)
- ○ Cleveland Fusion (9)
- ○ Columbus Comets (10)
- ○ Dallas Elite (11)
- ○ Daytona Waverunners (12)
- ○ DC Divas (13)
- ○ Derby City Dynamite (14)
- ○ Detroit Dark Angels (15)
- ○ East Tx Crusaders (16)
- ○ Everett Reign (17)
- ○ Fayetteville Fierce (18)
- ○ Flint City Riveters (19)
- ○ Houston Power (20)
- ○ Huntsville Tigers (21)
- ○ Indy Crush (22)
- ○ Jacksonville Dixie Blues (23)
- ○ Kansas City Titans (24)
- ○ Keystone Assault (25)
- ○ Mile High Blaze (26)
- ○ Minnesota Machine (27)
- ○ Orlando Anarchy (28)
- ○ Pacific Warriors (29)
- ○ Philadelphia Phantomz (30)
- ○ Pittsburgh Passion (31)
- ○ Portland Shockwave (32)
- ○ Richmond Black Widows (33)
- ○ S. Oregon Lady Renegades (34)
- ○ Seattle Majestics (35)
- ○ Sin City Trojans (36)
- ○ St. Louis Slam (37)
- ○ Tacoma Trauma (38)
- ○ Tampa Bay Inferno (39)

- ○ Tri Cities Thunder (40)
- ○ Toledo Reign (41)
- ○ Utah Blitz (42)
- ○ Ventra Wolfpack (43)
- ○ West Coast Lightning (44)
- ○ West Michigan Mayhem (45)
- ○ I did not play on a WFA team in 2016 (46)

Q4 Use the following definition of a concussion to answer the question below. Definition of a concussion: A concussion is a condition resulting from the effects of a hard blow to the head followed by a variety of symptoms that may include any of the following: blurry vision, confusion, dizziness, feeling hazy, feeling very drowsy, headache, nausea, not feeling right and sensitivity to light or sound. As a result of football, did you sustain a medically-diagnosed concussion (i.e., diagnosed by an athletic trainer, medical professional, or coach trained on concussions) OR non-medically diagnosed concussion (i.e., diagnosed by yourself, another player, a coach not trained on concussions, etc.) during the 2016 WFA football season?

- ○ Yes (1)
- ○ No (2)

If no is selected, then skip to end of survey

Q5 As a result of football, how many medically-diagnosed concussions (i.e., diagnosed by an athletic trainer, medical professional, or coach trained on concussions) did you sustain during the 2016 football season?

- ○ 0- Did not sustain a medically-diagnosed concussion (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q6 As a result of football, how many non-medically diagnosed concussions (i.e., diagnosed by yourself, another player, a coach not trained on concussions, etc.) did you sustain during the 2016 football season?

- ○ 0 - Did not sustain a non-medically diagnosed concussion (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q7 How many non-medically diagnosed concussions as a result of football-related activities that you sustained during the 2016 football season were NOT reported to a coach, athletic trainer, or medical professional?

- ○ 0 -Did not sustain a non-medically diagnosed concussion (1)
- ○ 0 - Non-medically diagnosed concussion(s) were reported (2)
- ○ 1 (3)
- ○ 2 (4)
- ○ 3 (5)
- ○ 4 + (6)

Q8 The following four questions pertain to concussion(s) sustained as a result of football-related activities during football practices. How many of your medically-diagnosed concussions occurred during football practices during the 2016 football season?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q9 How many of your non-medically diagnosed concussions occurred during football practices during the 2016 football season?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q10 Which position(s) were you playing during football practices when your medically-diagnosed concussion(s) occurred? (Select all that apply.)

- ❑ My concussion(s) did not occur during practices (1)
- ❑ My concussion(s) were non-medically diagnosed (2)
- ❑ Quarterback (3)
- ❑ Running back (fullback, halfback) (4)
- ❑ Wide receiver (5)
- ❑ Offensive line (tackle, guard, center, tight end) (6)
- ❑ Defensive back (cornerback, safety) (7)
- ❑ Linebacker (8)
- ❑ Defensive line (end, tackle) (9)
- ❑ Special teams (kick or punt returner) (10)
- ❑ Special teams (all positions EXCEPT kick or punt returner) (11)

Q11 Which position(s) were you playing during football practices when your non-medically diagnosed concussion(s) occurred? (Select all that apply.)

- ❑ My concussion(s) did not occur during practices (1)
- ❑ My concussion(s) were medically-diagnosed (2)
- ❑ Quarterback (3)
- ❑ Running back (fullback, halfback) (4)
- ❑ Wide receiver (5)
- ❑ Offensive line (tackle, guard, center, tight end) (6)
- ❑ Defensive back (cornerback, safety) (7)
- ❑ Linebacker (8)
- ❑ Defensive line (end, tackle) (9)
- ❑ Special teams (kick or punt returner) (10)
- ❑ Special teams (all positions EXCEPT kick or punt returner) (11)

Q12 The following four questions pertain to concussion(s) sustained as a result of football-related activities during football games. How many of your medically-diagnosed concussions occurred during football games during the 2016 football season?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q13 How many of your non-medically diagnosed concussions occurred during football games during the 2016 football season?

- ○ 0 (1)
- ○ 1 (2)
- ○ 2 (3)
- ○ 3 (4)
- ○ 4 + (5)

Q14 Which position(s) were you playing during football games when your medically-diagnosed concussion(s) occurred? (Select all that apply.)

- ❑ My concussion(s) did not occur during games (1)
- ❑ My concussion(s) were non-medically diagnosed (2)
- ❑ Quarterback (3)
- ❑ Running back (fullback, halfback) (4)
- ❑ Wide receiver (5)
- ❑ Offensive line (tackle, guard, center, tight end) (6)
- ❑ Defensive back (cornerback, safety) (7)
- ❑ Linebacker (8)
- ❑ Defensive line (end, tackle) (9)
- ❑ Special teams (kick or punt returner) (10)
- ❑ Special teams (all positions EXCEPT kick or punt returner) (11)

Q15 Which position(s) were you playing during football games when your non-medically diagnosed concussion(s) occurred? (Select all that apply.)

- ❑ My concussion(s) did not occur during games (1)
- ❑ My concussion(s) were medically-diagnosed (2)
- ❑ Quarterback (3)
- ❑ Running back (fullback, halfback) (4)
- ❑ Wide receiver (5)
- ❑ Offensive line (tackle, guard, center, tight end) (6)
- ❑ Defensive back (cornerback, safety) (7)
- ❑ Linebacker (8)
- ❑ Defensive line (end, tackle) (9)
- ❑ Special teams (kick or punt returner) (10)
- ❑ Special teams (all positions EXCEPT kick or punt returner) (11)

Q16 Following your medically-diagnosed concussion(s) during the 2016 football season, did you? (Check all that apply.)

- ❑ Return to practice or play the same day (1)
- ❑ Return to practice or play within 24 hours (2)
- ❑ Return to practice or play within 48 hours (3)
- ❑ Return to practice or play within 7 days (4)
- ❑ Return to practice or play within 14 days (5)
- ❑ Other- please specify (6) _____

Q17 Following your non-medically diagnosed concussion(s), did you? (Check all that apply.)

- ❑ Return to practice or play the same day (1)
- ❑ Return to practice or play within 24 hours (2)
- ❑ Return to practice or play within 48 hours (3)
- ❑ Return to practice or play within 7 days (4)
- ❑ Return to practice or play within 14 days (5)
- ❑ Other- please specify (6) _____

APPENDIX D

INFORMED CONSENT

Informed Consent

Informed Consent (provided as email script with link to electronic survey)

Protocol Title/Subject Heading: Concussion Prevalence and Reporting in Women's Professional Football

Dear Women's Professional Football player,

I would like to invite you to take part in a study that will explore concussion prevalence and reporting in Women's Professional Football. You have been sent this invitation as your team is listed in the Women's Football Alliance. Your team owner has agreed to forward this survey to you.

This survey will take less than 10 minutes to complete and is entirely voluntary and anonymous. By accessing the provided link below and completing the survey, you are consenting to take part in this study. You can withdraw or refuse to answer any question without consequences at any time. You also can withdraw from the study at any time for any reason without penalty. There are no reasonably foreseeable risks associated with participation in this study. There is no direct benefit to participating in this study.

The results of this study may be published in scientific literature or presented at professional meetings using aggregate data only. All information will kept anonymous and data will not be linked with personally identifiable information.

Please only complete this survey if your team was a member of the Women's Football Alliance AND you were an active player during the 2016 football season.

To access the survey, please follow this link:
https://uwlacrosse.qualtrics.com/SE/?SID=SV_a2JvX1Sd9yCWYDj

Questions regarding study procedures may be directed to Tiffany Lein, the principal investigator at Lein.tiff@ulwax.edu/ (608) 518-7046, or her faculty advisor, Michele Pettit at mpettit@uwlax.edu/ 608-785-6789. Questions regarding the protection of human subjects may be addressed to irb@uwlax.edu.

Thank you for taking the time to complete this survey.

Sincerely,

T. Lein

Tiffany Lein
Masters of Public Health Candidate
University of Wisconsin – La Crosse