HOW DO PARENTS OF PREADOLESCENT FOOTBALL PLAYERS ***REALLY*** FEEL ABOUT CONCUSSION EDUCATION AND THE RISK OF CONCUSSION INJURIES?

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DEDICATION

I dedicate this dissertation to my family. To my parents, "Sam" (M.E.) and Jo Dews. You were the first ones in my life to teach me about love, and life, and learning. Teaching a child not only the importance of learning, but how much FUN it can be to learn is truly a wonderful gift, and you gave me that gift throughout my life. You have always been there to support me and my dreams, and have continuously told me I could do anything I wanted to if I put my mind to it. Fortunately, I believed you and was able to complete this life goal. Thank you for your unconditional love and for raising me to be confident, assertive, and just tenacious enough not to accept "No" for an answer. Even though Mom is not here to see me graduate, she saw me in the process and knew I was close to reaching my goal. I miss you, Mom. Dad will be there to see me graduate and we know you'll be with us too. I love you both so much.

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ABSTRACT

KIMBERLY DEWS MORY

HOW DO PARENTS OF PREADOLESCENT FOOTBALL PLAYERS ***REALLY*** FEEL ABOUT CONCUSSION EDUCATION AND THE RISK OF CONCUSSION INJURIES?

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The effects of repetitive injuries to the brain in collegiate and professional athletes have received much attention in the media and sports world in the past few years due to the tragic deaths of retired athletes. Autopsies have revealed extensive damage to the brains of these athletes that has been directly linked to their participation in high-impact sports. Increased awareness and recognition of this disease process has occurred in recent years, and this condition has become known as chronic traumatic encephalopathy (CTE).

Concussions are the most common type of traumatic brain injury, with an estimated 1.6 to 3.8 million concussion injuries annually that are related to participation in sports and recreational activities. The majority of concussion injuries do not result in a loss of consciousness. However, these injuries can lead to cognitive and physical deficits that intensify with repeated injuries

While much attention has been given to increasing education and awareness of concussion injuries in high school and college athletes, there has been very little information targeting concussion education in young athletes. This study focused on parents' perception of risk of concussion injuries in 8 to13-year-old boys playing select

football in the DFW area. The purpose of this study was: (a) to examine the relationship between parents' educational attainment, previous experience playing sports, knowledge of concussion injuries, and perceived risk of their sons sustaining a concussion injury while participating in select football, and (b) to explore parents' perceptions about concussion injury risk and concussion injury education and prevention.

A previously published survey was adapted to a paper/pencil survey focused on parents' perceptions of risk of their sons incurring a concussion injury while playing select football. A convenience sample was utilized by the researcher at select football games and practices to recruit parents/caregivers for self-administration of the survey that could be completed in 10-15 minutes. There were twenty-three Likert-scale questions divided into the six constructs of the health belief model (HBM): perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action. There were fourteen questions used to gather demographic information and five additional open-ended question were used to enrich the data results. Ninety-nine surveys were collected and analyzed using ANOVAs and correlation analysis to examine relationships between the parents' educational attainment, previous experience playing sports, and knowledge of concussion injuries with the parents' perceived risk of concussion injury in their 8 to13-year-old sons playing select football.

Results indicated that knowledge of concussion injuries was the only independent variable that had a significant effect on one of the HBM constructs which was self-efficacy ($p < .001$). This finding was significant in that no other variables impacted a parent's perception about the risk of concussion injury other than the parent having

received concussion education. Responses to the open-ended questions showed a wide range of opinions and attitudes towards concussion education resources and confirmed the need for resources to be presented in a wide variety of formats on an on-going basis for parents, coaches, medical personnel, and the athletes.

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CHAPTER I

INTRODUCTION

The effects of repetitive injuries to the brain in collegiate and professional athletes have received much attention in the media and sports world in the past few years due to the tragic deaths of retired athletes. Autopsies revealed extensive damage to the brains of these athletes that has been directly linked to their participation in high-impact sports (Omalu, Hammers, & Fitzsimmons, 2010). Increased awareness and recognition of this disease process has occurred in recent years, and this condition has become known as chronic traumatic encephalopathy (CTE) (Saulle & Greenwald, 2012).

Concussions are the most common type of traumatic brain injury, with an estimated 1.6 to 3.8 million concussion injuries annually that are related to participation in sports and recreational activities (Covassin, Elbin, & Sarmiento, 2012). The majority of concussion injuries do not result in a loss of consciousness. However, these injuries can lead to cognitive and physical deficits that intensify with repeated injuries. In a study examining the brains of 246 former football players, results indicated that participation in tackle football prior to the age of 12, was predictive of earlier onset of cognitive and behavioral symptoms (Alosco et al., 2018). Symptoms of repeated concussive brain injuries include poor attention and concentration, impaired memory, disorientation and confusion, headaches and dizziness, impaired social behavior, decreased language skills, and decreased ability to learn (Gavett et al., 2011; McKee et al., 2012; Peller, Murphy, & Subramaniam, 2009). Even when signs and symptoms of concussion injuries are not

present, magnetic resonance imaging (MRI) studies have demonstrated significant neurodegenerative injury as a result of repetitive hits to the head (Bailes, Petraglia, Omalu, Nauman, & Talavage, 2013; Kim, 2018).

There is ample research to support that sports-induced CTE does exist. Football has received the most notoriety for concussion injuries; but many other sports also have a proclivity towards concussion injuries such as basketball, cheerleading, soccer, bicycling, and wrestling (Centers for Disease Control and Prevention [CDC], 2012; Daneshvar, Nowinski, McKee, & Cantu, 2011). While CTE research efforts have primarily targeted professional athletes, there is increasing concern regarding the age of onset of CTE and the potential for early-onset of CTE among children and youth, namely due to the steady increase in the occurrence of traumatic brain injuries within the past 10 years. For example, from 2001 to 2012, the incidence of sports-related injuries consisting of concussion or traumatic brain injury doubled in children younger than 19 years of age (CDC, 2017a) and it is unknown if this is a result of increased awareness of concussion injuries, or an actual increase in incidence of concussion injuries in youth.

Even with research documenting the existence of CTE among youth, there is meager evidence determining the most effective methods of prevention and treatment. Concussion education is available using printed materials and online formats. Heads Up! (CDC, 2019b) concussion information is available to coaches, medical professionals, parents and athletes; yet evidence suggests that concussion education is needed by coaches, parents, and medical personnel to recognize signs and symptoms of concussion injuries (Glang, Koester, Beaver, Clay, & McLaughlin, 2010; Harmon et al., 2019;

Register-Mihalik et al., 2018). In one of the few studies examining parental knowledge of sports-related concussion injuries, Patel and Trowbridge (2017) found that too much or too little information, the format of the information presented (verbal, printed, online), and the source of the information being shared with parents, were often identified as barriers for parents learning about sports-related concussions. Patel and Trowbridge (2017) emphasized not only the need for parents to obtain concussion education, but also the need to determine the most effective method of delivering information for parents to understand and retain information about concussions.

Statement of Purpose

The primary purpose of this study was to examine the relationship between parents' educational attainment, previous experience playing sports, knowledge of concussion injuries, and perceived risk of their sons sustaining a concussion injury while participating in select football. The secondary purpose was to explore parents' perceptions about concussion injury risk and concussion injury education and prevention.

Research Questions

This study posed the following research questions:

1. Is there a relationship between parental educational attainment, concussion education received by parents, parents' experience in sports participation, and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self -Efficacy, and Cues to Action)?

2. What types of concussion education strategies/programs do parents recommend?

3. What source(s) of concussion injury education do parents trust?

4. What do parents perceive as benefits of their sons playing select football that outweigh the risks of experiencing concussion injury?

5. What are parents' recommendations for preventing and responding to concussion injuries in young select football players?

Hypotheses

The following null hypotheses were tested with significance set at $p = .01$:

Hypothesis 1: There will be no significant difference between parental educational attainment and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self – Efficacy, and Cues to Action).

Hypothesis 2: There will be no significant difference between receipt of concussion education by parents and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self -Efficacy, and Cues to Action).

Hypothesis 3: There will be no significant difference between parents' experience in sports participation and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self -Efficacy, and Cues to Action).

Delimitations

The current study had the following delimitations:

1. Survey items for this study were adapted from a survey developed by Otago, Spittle, Garnham, Reynolds, and Finch (2005) to examine parents' perceptions of sports injury risk.

2. Participants comprised a random sample of parents of 8 to 13-year-old boys playing select football in the Dallas-Fort Worth, TX (DFW) area. Participants' zip codes were used to ensure a cross-sectional sample of the socioeconomic areas within the DFW area.

3. Parents who also coached the select football team were not asked to participate in the study.

Limitations

The current study had the following limitations:

1. A convenience sample of parents of select football players between 8 and 13 years old in the DFW area participated in the study, which prevents generalization of study results.

2. The sample size was relatively small due to only one researcher attending youth select football practices and games to collect data throughout the DFW area. The small sample size prevents generalization of study results.

3. Some parents may not have participated in the study due to the presence of other parents in close proximity, which may have affected study results.

4. The original survey instrument was modified, which may have affected internal validity and reliability of the instrument.

Assumptions

The assumptions for this study were as follows:

1. The survey was an appropriate instrument to assess parents' risk perceptions regarding their sons playing youth select football.
2. Participants were able to understand, read, and speak English.
3. Participants responded to the survey questions honestly and as accurately as possible.

Definition of the Terms

Chronic traumatic encephalopathy (CTE) **–** progressive, degenerative disease as a result of repetitive brain injuries, including concussion injuries (Boston University, 2009).

Cognitive impairment **–** difficulties with memory, new learning, attention and concentration, decision making, executive function, information processing speed, language, visuospatial skills, and motor skills (CDC, 2011; Oncology Nursing Society, n.d.).

Concussion injury **–** a type of brain injury caused by a blow to the head, a bump, or a jolt that injures the brain and can create chemical changes in the brain, and stretch and damage brain cells (CDC, 2017b).

Health belief model (HBM) – a framework used since the 1950s to plan and implement interventions for health-related behaviors. The HBM consists of six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action,

and self-efficacy. These constructs guide individuals' health behaviors (Skinner, Tiro, & Champion, 2015).

Importance of the Study

It is well-documented that repetitive concussion injuries can lead to serious brain injuries and severely impact academic, social, and emotional development of youth athletes (Collins et al., 2002; Daneshvar et al., 2011a; Hirst, Haas, Teague, Whittington, & Taylor, 2018; McGrath, 2010; Moore, Kay, & Ellemberg, 2018). Parents are instrumental in protecting their youth athletes from long-term effects of repetitive concussion injuries, but they require information and education in order to make appropriate decisions about their child's health and safety. However, Patel and Trowbridge (2017) revealed that parents did not feel confident about what they knew about concussion injuries and did not believe they could recognize the symptoms of a concussion injury.

Much of the attention surrounding concussion injuries has focused on professional, college, and high school athletes. However, younger athletes are also involved in competitive sports that can present concussion injury risk, including select football. Select football teams are comprised of players that may have been recruited or participated in tryouts for the team. Select teams have a higher level of competition than recreational teams, and select players tend to practice more days per week and play in tournaments on the weekends. In addition, there are many leagues in north Texas comprised of select teams; and players typically begin at age five or six and continue through high school. Parents often want their children on specific teams to work with

coaches known to have a winning record to provide increased coaching and more exposure for their child (Cisar, 2013; Texas Select Sports Center, 2019; J. Seawright, personal communication, May 27, 2017). Therefore, there is a need to better understand concussion injury in youth athletes, particularly those playing sports such as select football.

Examining parents' understanding of concussion injuries and their confidence in recognizing signs and symptoms of a concussion is imperative to identifying the elements necessary for effective concussion education and prevention. This study fills a gap in the literature regarding parents' perceptions of risks related to their 8 to 13-year-old sons sustaining a concussion injury while participating in select football. Study findings provided insight into factors that may influence parents' perceptions concerning the seriousness of concussion injuries and their decision to consent to their sons playing select football. The information gleaned from this study can be used by health educators to plan, implement, and evaluate concussion prevention programs in a variety of settings such as schools, community sports and recreation programs, and children's orthopedic sports clinics. Study findings can also be used to develop health communication campaigns to increase knowledge and foster parents' self-efficacy for effectively preventing and responding to concussion injury in young athletes. As a result, concussion prevention education efforts have the potential to make a significant impact in the academic, emotional, and long-term well-being of young athletes playing football and other sports in which concussion injuries occur.

CHAPTER II

REVIEW OF LITERATURE

This chapter provides a review of the literature addressing the occurrence of CTE and concussion injuries. A description of concussion will be presented and the literature review will then describe the management of concussion including the diagnosis, treatment, and prevention of concussion injuries. The current literature addressing the use of the HBM in the planning and implementation of health-related behavior will then be presented. Databases that were utilized for this literature review included CINAHL Complete, EBSCOhost Databases, Journals at Ovid Full Text, Medline with Full Text, PsycINFO, PubMed, and Wiley Online Library. Figure 1 provides a visual representation of the review of literature.

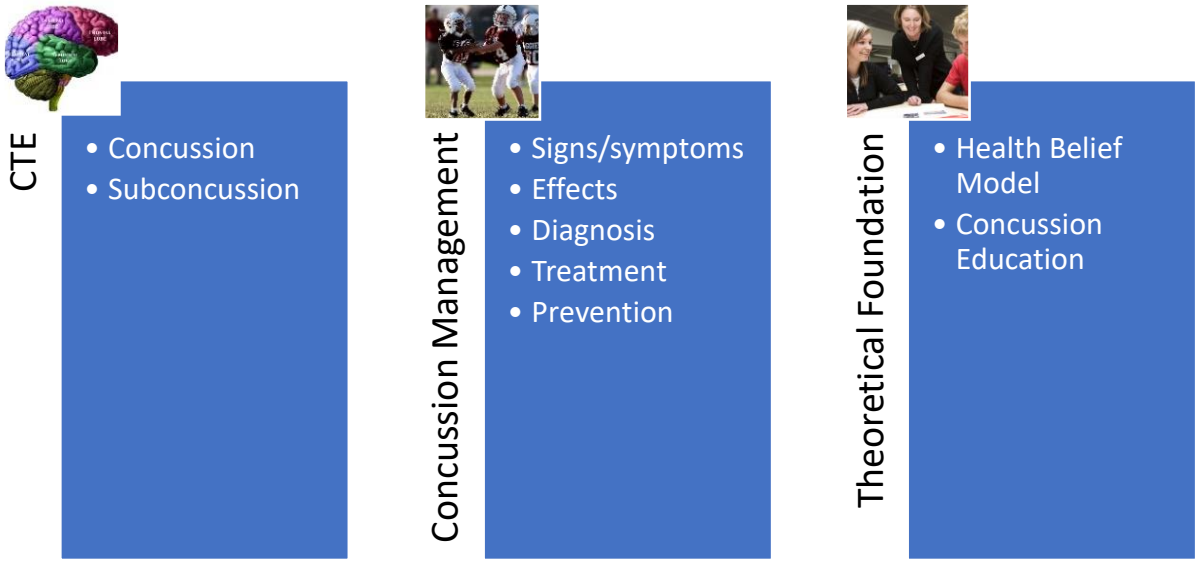

Figure 1: Visual Representation of Review of Literature

CTE has received significant attention in the media in the past few years due to the increasing number of deaths believed to be a direct result of brain damage caused by CTE (Cantu, 2007; Gardner, Iverson, & McCrory, 2014; Khurana & Kaye, 2012; McCrory et al., 2009; Omalu et al., 2010). Although attention to the long-term effects of CTE initially focused on professional sports, particularly American football, awareness and concern has increased regarding the occurrence of mild traumatic brain injuries, or concussion injuries, in collegiate, high school, and youth sports (Jancin, 2009; Latner, 2010).

Background

The definition of a "concussion" injury has undergone revision in the past several years as researchers and the medical community struggle to agree on the criteria that determines a concussion injury has occurred. In 2001, the International Ice Hockey Association, the Federation Internationale de Football Association Medical Assessment and Research Centre, and the International Olympic Committee Medical Commission organized the first International Symposium on Concussion in Sport held in Vienna, Austria. The purpose of the Symposium was to present information related to all facets of concussion including mechanism of injury, diagnosis, treatment, and prevention, and develop recommendations to improve the management of concussion injuries in athletes (Aubry et al., 2002).

From this Symposium, a group of experts were organized into the Concussion in Sport Group (CISG) to establish a more inclusive and consistent definition of concussion. From the CISG, the following definition of concussion was developed:

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

1. Concussion may be caused 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 I the rapid onset of short-lived impairment of neurological function that resolves spontaneously.
3. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than structural injury.
4. Concussion results in a graded set of clinical syndromes that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course.
5. Concussion is typically associated with grossly normal structural neuroimaging studies (Aubry et al., 2002, p. 6).

The CDC (2019a) defined concussion as:

> a type of traumatic brain injury 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. This sudden movement can cause the brain to bounce around or twist in the skull, creating chemical changes in the brain and sometimes stretching and damaging the brain cells. (CDC, 2019a, para.1)

Concussion injuries can occur without a loss of consciousness (CDC, 2019b; Harmon et al., 2013; Guskiewicz & Valovich McLeod, 2011; Noble & Hesdorffer, 2013). Although concussion injuries are not considered life threatening, research has shown that an increasing number of youth, high school, and college athletes are experiencing long-term negative effects of concussion injuries, including impaired memory, decreased concentration, chronic headaches, dizziness, fatigue, and nausea (Field, Collins, Lovell, & Maroon, 2003; Khurana & Kaye, 2012; Stern et al., 2011). Although attention to concussion injuries has focused on high school and collegiate athletes, Bahrami et al. (2016) found that after one season of playing football, boys between the ages of 8 and 13 years old showed statistically significant changes in the white matter tracts of the brain that are associated with concussion injuries.

Incidence

Between 2010 and 2016, studies by the CDC (2019b) showed approximately two million children under the age of 18 had visits to hospital emergency departments (ED) related to a traumatic brain injury caused from a sport or recreational activity. These ED visits included concussion injuries as well as other injuries to the head. Football accounted for 13.1% of traumatic brain injuries necessitating an ED visit for boys between 5 and 9 years of age, and for 32.6% of ED visits for males between the ages of 10 to14. However, these figures are likely low as concussion injuries frequently go unreported (CDC, 2019b; Dompier et al., 2015; Guskiewicz & Valovich McLeod, 2011; Harmon et al., 2013). Arbogast et al. (2016) found that approximately 75% of youth between the ages of 5 and 17 years who sought medical attention for a concussion injury

went to a primary care physician rather than an ED. Similar to previous studies, these numbers are likely to be low due to underreporting of concussion injury. In a study examining the incidence rates of concussion in 8 to 10-year-olds and 11 to 12-year-olds playing football, it was found that concussions occurred during games approximately twice as often as during collegiate football games and almost three times more frequently than in high school games. Additionally, concussion occurred in 11 to 12-year-olds almost three times more often than in 8 to 10-year-olds (Kontos et al., 2013). In another study, incidence rates of concussion in youth football were found to be similar to the incidence rates seen in high school and college football (Dompier et al., 2015).

Symptoms of Concussion

Research has tended to focus on the occurrence and effects of concussion injuries in high school and college-aged athletes (Kirkwood, Yeates, & Wilson, 2006). But the occurrence of concussion injuries in children younger than high school age has generated greater need for further research to determine the long-term effects of concussion injuries in children (Brett, Kuhn, Yengo-Kahn, Solomon, & Zuckerman, 2018; Harmon et al., 2013; Karlin, 2011; Metzl, 2006). Early research in brain physiology suggested that the younger the individual was when a brain injury occurred, the greater the recovery from that injury due to the plasticity of the brain. This notion was primarily a result of studies by Dr. Margaret Kennard (1936), who found that when various areas of the brain were surgically removed or destroyed in chimpanzees and gibbon monkeys, the resulting effects were much more pronounced and severe in adult animals than were found in infant and young animals. When the motor areas of the brain were destroyed in young

animals, they were able to regain almost full function of the affected limbs within a few weeks or months compared to the adult animals that never fully recovered function.

Advancements in medical technology have now shown that damage to a child's developing brain caused by concussion can be much greater than previously believed (Hirst, et al., 2018; Karlin, 2011; Kirkwood et al., 2006). Studies have shown concussion injuries cause microscopic axonal injury in the brain, which, in turn, creates metabolic and pathophysiologic changes in the brain (Harmon et al., 2013; Noble & Hesdorffer, 2013; Vagnozzi et al., 2010). An inflammatory response to the injury occurs, and there is an imbalance of ions that affects neurotransmitters (Slobounov et al., 2014). Proton magnetic resonance spectroscopy was utilized in a study by Vagnozzi et al. (2010) in which individuals who had experienced a concussion were compared to a control group without concussion. Results indicated that individuals who had suffered a concussion injury were found to have significant changes in the metabolism of the brain before eventually returning to normal levels. It has been hypothesized that a concussion injury negatively affects the production of adenosine triphosphate (ATP) and N-acetylaspartate (NAA), two primary metabolites involved in fluid balance in the brain and in lipid and myelin synthesis used for myelination of neuronal axons. This may explain the symptoms of concussion such as headache, equilibrium and visual disturbances, sleep disruption, and cognitive deficits (Harmon et al., 2013; Vagnozzi et al., 2010).

Diagnosis of a concussion injury provides inherent challenges in that accurate diagnosis is dependent on individuals self-reporting symptoms of concussion, or trained personnel must be able to observe symptoms in an individual suspected of suffering a

concussion injury. There is no objective medical test such as computed tomography (CT scan) or MRI that can be utilized to determine if a concussion injury has occurred (Harmon et al., 2019; Kirkwood et al., 2006; O'Keefe, Beamon, Brewer, & Niceler, 2018). It has been well-documented that relying on athletes to self-report symptoms of concussion has resulted in under-reporting the incidence of concussion. This has been attributed to athletes not wanting to be removed from the game, not wanting to be teased by their teammates, or not recognizing that they are suffering from concussion symptoms (CDC, 2019b; Dompier et al., 2015; Guskiewicz & Valovich McLeod, 2011; Harmon et al., 2013).

A myriad of symptoms may be experienced by individuals incurring a concussion injury (Harmon et al., 2013; Noble & Hesdorffer, 2013; Guskiewicz & McLeod, 2011). Signs and symptoms of a concussion injury are listed in Table 1.

Table 1

Signs and Symptoms of a Concussion

Physical

- Headache
- Nausea
- Vomiting
- Balance problems
- Dizziness
- Visual problems
- Fatigue
- Sensitivity to light
- Sensitivity to noise
- Numbness/tingling
- Dazed
- Stunned

Cognitive symptoms

- Feeling mentally "foggy"
- Feeling slowed down
- Difficulty concentrating
- Difficulty remembering
- Forgetful of recent information and conversations
- Confused about recent events
- Answers questions slowly
- Repeats questions

Emotional symptoms

- Irritable
- Sadness
- More emotional
- Nervousness

Sleep symptoms

- Drowsiness
- Sleep more than usual
- Sleep less than usual
- Difficulty falling asleep

(Harmon et al., 2013)

Although not all individuals experience all of these symptoms, research has shown that the more symptoms that are exhibited and the more severe the symptoms, there is an increased likelihood of an extended recovery time (Harmon et al., 2013; Hirst et al., 2018).

Effects of Concussion on Youth

There is concern that children incurring a concussion injury are vulnerable to increased effects of the injury due to the neurodevelopment of their brain and increased vulnerability to cerebral edema (Alosco et al., 2018; Field et al., 2003; Guskiewicz & Valovich McLeod, 2011; Hirst et al., 2018; Stamm et al., 2015a; Stamm et al., 2015b). Children may be at a higher risk of not reporting symptoms of concussion due to their lack of knowledge or understanding of concussion injuries, and parents and coaches may not observe or recognize the signs of concussion (Hirst et al., 2018; Moore et al., 2018). It is estimated that 90% of individuals with a known concussion injury typically recover within a 2 week time frame (Harmon et al., 2019; Hirst et al., 2018). However, recovery in youth younger than 14 years old has been shown to take up to 4 weeks. In a study of 3,063 children with a concussion injury, approximately 33% exhibited signs or symptoms of a concussion longer than a month after injury (Zemek et al., 2016). Symptoms that continue to occur in children longer than 4 weeks after injury are considered post-concussion syndrome (PCS) and pose increased risk of persistent symptoms such as dizziness, memory deficits, irritability, and attention disorder (Harmon et al., 2019; Hirst et al., 2018).

Of further concern is the lack of research examining the recovery from concussion in youth under the age of 14 years as the majority of studies have addressed concussion and its effects on high school, college, and professional athletes (Corwin et al., 2014; Karlin, 2011). Research has shown that high school athletes require a longer recovery period from concussion and demonstrate significant memory deficits, slower processing, and decreased attention and concentration when compared to college athletes who suffer a concussion (Field et al., 2003). It is not fully understood why concussions at a younger age appear to result in prolonged recovery, but the implication is clear: children are at an increased risk of exhibiting severe deficits and requiring an extensive recovery time in order to fully recover from concussion injuries (Corwin et al., 2014; Daneshvar et al., 2011a; Karlin, 2011; Moore et al., 2018).

In a study of 247 children between the ages of 5 and 18 years old who had suffered a concussion injury, 81% of the children exhibited vestibular deficits, a possible indicator of the severity of the concussion injury (Corwin et al., 2015; McCrory et al., 2009). The study also found that children with vestibular symptoms required three times longer to regain premorbid processing speed and visual and verbal memory skills compared to the children who had sustained a concussion but did not exhibit vestibular signs. These findings hold implications for a child's academic performance as vestibular deficits can negatively affect reading, writing, and computer activities (Corwin et al., 2015).

Visual deficits have also been exhibited by children with a concussion injury and have been found to be predictive of a prolonged recovery (Corwin et al., 2014; Master et

al., 2017; Moore et al., 2018). One study found that 69% of children between the ages of 11 and 17 with a concussion injury exhibited visual disturbances at 6 months post-injury (Master et al., 2016). Children who exhibited visual disturbances and/or vestibular deficits required a significantly longer period of time to return to school; requiring an average of 59 days compared to an average of 6 days for children without visual or vestibular disturbances (Corwin et al., 2015).

Psychological and/or behavioral concerns can also result from a concussion injury (Hirst et al., 2018; Karlin, 2011; McGrath, 2010; Moore et al., 2018). For example, depression and mood disorders have been well-documented among professional athletes who have suffered concussion injuries. Similarly, studies focused on the effects of concussion in adolescents found an increased incidence of mood and behavioral disorders following concussion. While there is a paucity of research examining the effects of concussion on the mental health of children, research with older athletes suggests a possible impact of concussion injuries on the mental health and behavior of children as well, necessitating additional research (Hirst et al., 2018; Moore et al., 2018).

Concussion has also been found to negatively affect cognitive-motor skills such as walking and computing simple math problems. Dalecki, Albines, MacPherson, and Sergio (2016) found impaired cognitive motor skills consisting of decreased stability and accuracy in 50 children and adolescents who had sustained a concussion when compared to age-matched children who did not have a history of concussion injury. Furthermore, the average length of time since incurring the concussion injury was 12 months, indicating a significant period of lapsed time between the occurrence of injury and the

decreased cognitive motor skills. Although there are few studies examining the motor effects of concussion on children younger than 14, there is concern that motor skills can be affected based on what has been observed in older athletes following concussion (Harmon et al., 2019; Moore et al., 2018).

The effects of concussion injury on the cognitive and academic abilities of young athletes have gained increasing attention in the past several years in light of findings in professional athletes. In a longitudinal study examining the effects of concussion 23 years post-injury, Hessen et al. (2007) found that individuals who had sustained a concussion injury as a child exhibited attention deficits in structured tasks and in their work as adults. Children who had suffered a concussion injury prior to the age of 10 also demonstrated increased difficulty in cognitive flexibility and shifting attention as adults. Children incurring a concussion injury also exhibit decreased ability to shift and sustain attention, impaired ability to recognize and self-correct errors, and increased behavioral deficits (Hirst et al., 2018; Moore et al., 2015). In a review of studies focused on concussion effects among children, Keightley et al. (2014) found that children who incurred a concussion and were past the acute phase of recovery demonstrated deficits in verbal and non-verbal memory recall as well as working memory, even though the children completed neuropsychological testing with normal results.

Effects of Previous Concussion

Most researchers agree that the greatest risk for long-term deficits occurs when an individual sustains a repeat concussion injury, particularly if the succeeding concussion occurs prior to recovery from the initial concussion injury (Brett et al., 2018; Corwin et

al., 2014; Harmon et al., 2019; Hirst et al., 2018; Iverson, Gaetz, Lovell, & Collins, 2004; Karlin, 2011; McGrath, 2010; Moore et al., 2018). Individuals who have suffered two or more concussions have been observed with more severe symptoms that have persisted for a longer period of time (Karlin, 2011). Studies have shown the risk of sustaining a subsequent concussion increases two to six times after incurring an initial concussion (Harmon et al., 2013; Iverson et al., 2004). Corwin et al. (2014) found that children with two or more concussions required more than twice as long for a full recovery, and recovery time for individuals with three or more concussions averaged 243 days compared to 64 days for children having suffered one concussion. Additionally, the students with three or more concussions required 3.6 times longer to return to school than those children with no more than one concussion injury (Corwin et al., 2014).

A controversial effect of subsequent concussion injuries is second impact syndrome (SIS), also known as dysautoregulation (Cantu, 2016). Some researchers believe this is the result of a second concussion injury or head impact prior to recovery from the initial concussion that causes a disruption of cerebral blood flow resulting in diffuse brain swelling, severe vascular congestion, and increased intracranial pressure. This phenomenon has been known to lead to herniation of the brainstem with death occurring in 50% of the patients and severe long-term residual effects occurring in 100% of those who survive the initial insult (Cantu, 2016; Karlin, 2011; McLendon, Kralik, Grayson, & Golomb, 2016). Others attest that this is not a specific syndrome, but rather the result of a poor recovery from an initial concussion injury. In a review of case studies examining individuals with a severe brain injury following a successive concussion

injury, McLendon et al. (2016) found that in 15 out of 17 cases, computed tomography showed diffuse cerebral edema with midline shift evident in all cases. Brainstem herniation resulted from severe cerebral edema in four out of the 15 cases (27%) (McLendon et al., 2016). The length of time between the initial concussion injury and the second concussion injury ranged from one hour to four weeks. Of the 17 cases reviewed, the second injury resulted in death or permanent disabilities in 12 of the patients, all who were younger than 20 years old (McLendon et al., 2016).

Some medical personnel and researchers believe that these catastrophic results are due to a second impact to the head and are not related to the first concussion injury. However, other researchers believe that if this were the case, there would be more incidence of second impact syndrome occurring following the first concussion injury. The most compelling argument for the existence of second impact syndrome is that research has shown that brain connectivity can be affected after an initial injury that can affect the parasympathetic system and cause increased vasodilation in the brain. This instability may result in a severe and critical response in the brain when a second concussion injury occurs, causing severe swelling. Male athletes younger than 20 years old are at an increased risk for this catastrophic injury, although it is not known why this phenomenon occurs more frequently in younger individuals (Karlin, 2011; McLendon et al., 2016).

Subconcussive Impacts

While the occurrence of concussion injuries in young athletes is a primary concern, subconcussive hits experienced by young athletes are also alarming. Sub-concussive hits are described as impacts to the brain that do not cause immediate effects or symptoms such as those seen in a concussion injury, but have been found by research to result in cognitive deficits due to the cumulative effects of the subconcussive hits (Concussion Legacy Foundation, n.d.; Johnson, Neuberger, Gay, Hallett, & Slobounov, 2014). One of the first studies to examine subconcussive hits in youth used the Head Impact Telemetry (HIT) System to measure the effects of head impacts on 9-12-year-old boys during real-time play in practices and games. The HIT System measures the amount of acceleration and rotational forces on the head during an impact. The HIT System was installed in the boys' helmets used throughout one season of football. The researchers found the players experienced an average of 240 $\pm$ 147 hits during the season with players averaging 19.2 $\pm$ 20.1 impacts measuring greater than 40 g (Cobb et al., 2013). G-force refers to the force of gravity placed on a being in relation to the force experienced in a free fall. A force of 40 g is equivalent to 40x the force on a body free-falling to the earth. While humans have been known to survive high levels of g-forces for split second periods of time, sustained forces above 10 g are known to cause permanent damage. Furthermore, a force of 100 g can be lethal, even if experienced momentarily such as in a motor vehicle crash (G-force, 2010). Cobb et al. (2013) found that the front of the boys' helmets sustained the greatest number of hits at 41%, and hits to the back of the head and side incurred 25% and 23% of the impacts, respectively. During the season,

four of the boys were diagnosed with a concussion injury. Findings indicated a slightly higher number of hits to the head in games as opposed to practices; however, one team in the study exhibited significantly fewer hits than the other two teams during practice as a result of different practice techniques such as limiting full body contact and reducing the number of scrimmages during practice (Cobb et al., 2013).

Daniel, Rowson, and Duma (2012) studied the number of hits to the head in seven 6-9-year-old boys playing football using a custom acceleration measurement device known as the 6DOF (Six Degrees of Freedom). During the season, 748 hits were recorded with the players sustaining an average of 107 hits to the head. Interestingly, 44 of the hits occurred during games, while 63 impacts happened during practices, resulting in an average of 6.7 impacts occurring during practices, and an average of 5.8 impacts happening during games. Daniel et al. (2012) found that the hits of the highest magnitude occurred during practices with 76% of the impacts above 40 g occurring during practices, and 100% of the hits greater than 80 g occurred during practices (Daniel, Rowson, & Duma, 2012).

In another study, MRI was utilized by Bahrami et al. (2016) to examine the impacts sustained by 8 to 13-year-old boys during one season of football. The study found that even though a concussion injury was not identified, MRI revealed evidence of changes in the white matter fiber tracts of the boys, suggesting damage from sub-concussive hits sustained during the season.

Age at First Exposure

In response to studies examining the incidence of CTE in professional athletes, researchers have attempted to determine factors that may lead to the cognitive deficits that have been identified later in life in individuals with CTE. Stamm et al. (2015a) administered clinical tests to determine the cognitive functioning of former professional football players and found players who began playing tackle football prior to age 12 demonstrated significantly lower scores in executive functioning, immediate and delayed recall, and verbal IQ scores when compared to former players who began playing tackle football after 12 years of age. The researchers also noted that the group of players who started tackle football after the age of 12, played in the NFL an average of 2 years longer than the players who began tackle football prior to 12 years old (Stamm et al., 2015a).

In an additional study, Stamm et al. (2015b) employed diffusion tensor imaging (DTI), an advanced technique of magnetic resonance imaging, to examine the structure of the corpus callosum in former professional football players who began playing tackle football before the age of 12 and in those players who began tackle football after the age of 12 years. The corpus callosum is the largest tract of neural fibers in the brain that provides communication between the right and left hemispheres of the brain. The corpus callosum is known to be very susceptible to diffuse damage to the neural axons when impact to the head occurs (Stamm et al., 2015b). Stamm et al. (2015b) found that the structure of the corpus callosum exhibited decreased myelination and evidence of decreased white matter microstructure in the players who began playing tackle football

prior to the age of 12 when compared to the group of players who started tackle football after 12 years of age (Stamm et al., 2015b).

A similar study by researchers at Boston University also found that the younger the former professional football player had been when he began playing tackle football; the worse the former player's cognitive skills were by middle age. Players who began playing tackle football before the age of 12, exhibited increased occurrences of cognitive and psychiatric impairment an average of 13 years earlier than players who began playing tackle football after 12 years of age (Alosco et al., 2018). While other factors such as alcohol and drug use, mental health, and genetic predisposition to health issues may also contribute to the players' cognitive and psychiatric impairments, there is concern for the cumulative effects of concussion that require further research (Harmon et al., 2019).

Management of Concussion Injury

Diagnosis

It is now well-recognized that an individual does not have to lose consciousness for a concussion to occur (Aubry et al., 2002; Harmon et al., 2019; Khurana & Kaye, 2012; McGrath, 2010). The importance of identifying signs and symptoms of a concussion as soon as possible after it occurs is imperative in order for athletes to receive proper treatment and to minimize the risk of sustaining additional injuries by returning to play too soon. High school and college-level games are usually attended by professional athletic trainers and coaches, the majority of whom have received at least some concussion education. However, in organized youth sports, coaches are typically parents who have volunteered to coach; and there is not the presence of athletic trainers at

practices or games. First responders are also not stationed at the field as is often seen at games with older athletes. This means that the recognition of the signs and symptoms of a concussion are dependent on the parents and coaches at a game or practice, and these adults may or may not have received education related to concussion injuries (Hirst et al., 2018; Karlin, 2011; Valovich McLeod, Schwartz, & Bay, 2007; Moore et al., 2018).

There are standardized tools that can be used to help identify the presence of a concussion injury in youth. The *Immediate Post-Concussion Assessment and Cognitive Testing-Pediatric* (*ImPACT-Pediatric*) (ImPACT Applications, 2019) tool is standardized for children between the ages of 5 and 11 and can be administered by trained personnel using an iPad. Gioia and Collins (2006) developed the *Acute Concussion Evaluation* (ACE) for medical personnel to assess for the presence of a concussion injury and is available on the CDC's Heads Up (CDC, 2019b) concussion site. The *Child-SCAT 5* (Concussion in Sport Group, 2017) has been standardized for use with children from 5-12 years of age and is used by medical personnel to determine the presence of a concussion injury. These instruments use orientation questions and cognitive tests to assess for a possible concussion injury. Additionally, there is the *Standardized Assessment of Concussion* that was developed by the Brain Injury Association of America in 1997 (Brain Injury Association of America, 1997). This protocol relies on pretesting to establish a baseline so that in the event of a possible concussion, the athlete's scores can be compared between the baseline and post-injury scores. The most significant drawback to the use of these tools is that they are designed to be used by trained medical personnel,

which, in turn, places the burden on the volunteer coaches and parents to identify a possible concussion injury in young athletes without the use of assessment tools.

In order for parents and coaches to identify a possible concussion injury, education regarding the signs and symptoms of a concussion must be provided. Gourley, Valovich McLeod, and Bay (2010) found that 68% of parents (n = 487) were able to recognize symptoms of concussion, and 43% of the parents identified that a player should not return to play after incurring a blow to the head. In a similar study, Valovich McLeod et al. (2007) examined knowledge of concussions in coaches and found that 60% of the coaches correctly identified symptoms of concussion. However, 42% believed that a loss of consciousness was required for a diagnosis of concussion. In another study, Rieger, Lewandowski, Potts, Potter, & Chin (2018) surveyed 180 parents of 5 to 12-year-old football players regarding concussion signs and symptoms; and 85% believed they would be able to recognize a concussion injury in their child. In addition, 5.6% reported that they thought their child had sustained a concussion injury, although it was never diagnosed or treated; and 27% of the parents stated that they had witnessed their child get "dinged" when receiving a hit to the head (Rieger, Lewandowski, Potts, Potter, & Chin, 2018).

Bloodgood et al. (2013) utilized online surveys to examine the awareness and perceptions of parents and youth athletes regarding concussion injuries. Results indicated that 85% of parents were aware of concussions. However, while 100% of parents 46-50 years of age stated they had heard about concussions, only 20% of parents between the ages of 18 and 25 years reported knowing about concussions. Of the youth between the

ages of 13 and 18, 84% reported knowledge of concussions; but when data was examined by ethnicity, 92% of Caucasian youth reported concussion awareness, while 79% of African American youth and 77% of Hispanic youth stated they had awareness of concussions.

As concussion injuries have increased in recent years, research has demonstrated that knowledge about concussion injuries has increased in coaches, parents, and athletes when education has been made available (Bagley et al., 2012; Covassin et al., 2012; Glang et al., 2010). However, there remains concern about the accessibility and use of concussion information. In one of the few studies examining parental knowledge of sports-related concussion injuries, Patel and Trowbridge (2017) found that too much or too little information, the format of the information presented (verbal, printed, online), and the source of the information being shared with parents, were often identified as barriers for parents learning about sports-related concussions. Parents reported that too much information or from too many different sources was confusing and hard to understand. In another study, Kay, Register-Mihalik, Ford, Williams, & Valovich McLeod (2017) surveyed parents of youth athletes and found that parents of school-aged children had less exposure to concussion education because it was not presented in the schools as it often is in high schools. The study also revealed little correlation between parents who had suffered a concussion injury themselves and their knowledge and attitudes towards concussions (Kay, Register-Mihalik, Ford, Williams, & Valovich McLeod, 2017).

Treatment

Unlike sports injuries that can be seen such as a broken arm or sprained knee requiring the use of crutches, a concussion injury does not manifest outward symptoms. After suffering a concussion, the individual typically has no observable signs yet may still be experiencing cognitive, physical, or emotional deficits, and sleep disturbances. Athletes diagnosed with a concussion should never return to play on the day of the injury and consensus of medical personnel and researchers is that a period of rest must be enforced before returning to play (Gagnon, Galli, Friedman, Grilli, & Iverson, 2009; Harmon et al., 2019; Hirst et al., 2018; Jamault & Duff, 2013; Karlin, 2011; Kirkwood et al., 2006; McGrath, 2010). Returning too quickly to activity increases the risk of prolonging symptoms of concussion for weeks and possibly months. Youth experiencing a concussion require not only physical rest but also cognitive rest. The recommendation for cognitive rest will differ for each individual and can be difficult for young athletes to follow, as this means no use of TVs, computers, video games, or cell phones. Loud conversations, group gatherings, and loud music also need to be avoided (Jamault & Duff, 2013).

A student's academic performance is often negatively affected by decreased attention and concentration, impaired processing skills, and diminished cognitive abilities arising from concussion injury. Young athletes are at particular risk for prolonged symptoms and decreased academic performance because they may not recognize the

difficulties they are having, and may not understand how they are related to the concussion injury. Because the signs and symptoms of concussion cannot be directly observed, teachers must also be watchful to discern changes in a child's behavior and academic performance. Elementary and middle school teachers do not typically receive concussion education, yet it is paramount for them to understand and recognize difficulties that may be exhibited by a student after suffering a concussion injury (Harmon et al., 2019; Hirst et al., 2018; Karlin, 2011; McGrath, 2010).

To maximize recovery, students must not return to the classroom too soon. There is no prescribed length of time for students to remain out of the classroom, but it is generally agreed that students should not return to the classroom or to active sports until they are no longer experiencing symptoms. Research has shown that students may continue to encounter cognitive deficits even after the physical symptoms are no longer present; and a period of neurocognitive therapy, physical therapy, academic accommodations, or the use of medications may be indicated (Harmon et al., 2019; Karlin, 2011; McGrath, 2010). Additional accommodations in the classroom may be indicated once the child returns to school. Allowing the child to have periods of rest during the school day and extra time to complete assignments and tests can be instrumental in the child's recovery and academic success. After suffering a concussion, some children are more sensitive to light and sound and may need to sit in a quieter area, not attend assemblies, and be allowed to wear caps or sunglasses to reduce their exposure. Using another person to read assignments and to take notes for the youth athlete may help the child who is experiencing headaches and difficulty with visual

processing tasks. A tutor may also be useful to help the student organize and attend to their assignments. Recognizing the need to provide academic assistance to the youth athlete after a concussion is key to the recovery of the child (McGrath, 2010).

Caution should be used when allowing a young athlete to return to play, which includes implementing an individualized care plan to determine a child's readiness to return to the field. Often, a gradual return to increased activity is utilized to assess the young athlete's recovery and readiness. The length of time between injury and return to play may be 1-2 days up to several weeks, depending on the severity of the child's symptoms. Frequent assessment of the youth athlete is required to ensure the child is truly symptom-free and is ready to return to school and physical activity (Harmon et al., 2019; Jamault & Duff, 2013; Karlin, 2011; Kirkwood et al., 2006; McCrory et al., 2009; Standaert, Herring, & Cantu, 2007; Zemek et al., 2016).

In a review of studies examining various interventions used with children and adults with a mild traumatic brain injury, Gravel et al. (2013) found there were very few studies addressing the effectiveness of treatment strategies. Gravel et al. used a Boolean search using terms to identify studies that examined concussion or post-concussion treatments during the acute phase, and databases included Embase, MEDLINE, EBM Reviews, ACP Journal Club, Cochrane Central Register of Controlled Trials, PsychINFO, and CinHAL. Out of 15,156 possible studies, only 120 met the criteria for further review of patients seeking treatment after a closed head injury with a Glascow Coma Score of 13 to 15, temporary loss of consciousness, altered state of consciousness, and transient focal neurological deficit. Only three articles focused on the use of a

specific intervention with children under the age of 16 years old. Two of the interventions focused on providing information about concussion injuries and contact information about where to seek further help, and the third intervention included neuropsychological testing 5-7 days after the injury occurred. In these three studies, the participants reported fewer concussion symptoms after six months; however, this would be an anticipated result in nearly all children who had suffered a concussion injury. None of these studies included more direct intervention strategies such as neuropsychological treatment or physical therapy, aimed at decreasing the effects of concussion on the physical and cognitive skills of young athletes.

Prevention

Various strategies have been put in place in an effort to decrease the number of concussion injuries in children. A primary focus of prevention is the use of upgraded protective equipment, most notably the helmets worn in football. Initially, helmets were redesigned from leather-padded caps to the hard-plastic helmets that were used beginning in the 1940s. The helmets were designed to prevent cervical fractures and to withstand repetitive hits in various circumstances such as extremely cold temperatures and very hot and humid weather. However, these helmets were not designed to take into account the different forces seen in concussion injuries (Daneshvar et al., 2011a). Today, helmets are being designed with various methods and placements of padding including inflatable pockets placed within the helmet. However, due to the many variables involved during football games and practices, and the inconsistencies in athletes reporting the occurrence of concussion injuries, there is a lack of research defining the effectiveness of various

helmet designs (Daneshvar et al., 2011a; Navia, 2012). There is also concern that the use of improved protective equipment can give young athletes the sense of protection and actually promote unsafe techniques and recklessness. Even then, the cost of the most recommended helmets with advanced safety features is between $300.00 and $1,800.00. High school and college teams plan for helmets as part of their team budget, but youth football does not have team budgets and the parents are required to purchase all of the necessary equipment; the cost which can be very prohibitive (Quillen & Mueller, 2019).

Beginning in 2009 in the state of Washington, state concussion laws were enacted in all 50 states and the District of Columbia, by April 2014. The objective of these laws is to increase concussion education, mandate that athletes who have experienced a concussion injury be removed from the game, and to ensure clearance from medical providers before the athlete can return to playing sports (Kim, Connaughton, Spengler, & Lee, 2017). There exists much variation in these state laws and the methods used to address the objectives of the law. For example, the age of the child and the setting that the statue was intended often differ depending on the state. Legislation in 24 of the states applies only in interscholastic sports, not recreational or youth leagues. House Bill 2038 in Texas, known as Natasha's Law, was passed in June 2011, and applies to middle school and high school sports activities. Other recreational and club sports programs in Texas can choose to abide by the state law but are not required to follow the protocols (Kim et al., 2017; Price, 2011). When making decisions about a young athlete's ability to return-to-play, there is no consensus among the states about who is able to make that call. For some states it is the coach, for others the athletic trainer is able to clear a youth

athlete to return-to-play, and other states require the clearance from a medical physician. The required concussion education also differs between states and may involve only the coaches, or may also require the parents and athletes to receive education. The education component may be in the form of watching a video, reading printed information, or attending in-person training (Kim et al., 2017).

Other strategies to prevent concussion injuries include rule changes, modifications in the training and techniques used in practices and in games, and even examination of the playing surfaces. Some leagues have restricted the number of practices the teams can be in full pads and helmets, and even the number of practices that are held each week. Increased strengthening techniques are being used by some teams to improve the youth athletes' overall strength, and natural surfaces are being chosen over artificial turf as there is some evidence that the artificial surfaces can result in increased speed and harder hits than natural turf (Harmon et al., 2019; Daneshvar et al., 2011b).

While research has focused on the occurrence of concussion injuries in professional, collegiate, and high school football players, there is increased concern that the effects of concussion injuries on younger athletes may be much more significant than initially believed.

Theoretical Foundation

Programs designed to improve the safety of children participating in organized and recreational sports should demonstrate evidence-based practices to improve the likelihood of decreasing unsafe behaviors and protecting the athletes from potentially life-changing injuries. Although behavioral and social science theories and models have

been used to address numerous health issues such as diabetes, heart disease, and lung diseases in individuals and communities, the application of behavioral theories and models in the prevention of sports-related injuries is relatively new and remains underutilized (Glanz, Rimer, & Viswanath, 2015; McGlashan & Finch, 2010). Finch (2006, 2011) asserted that sports injury prevention programs should include a theoretical background to identify the determining factors necessary to address in the design and implementation of effective intervention programs. The HBM is one of the most common models used in health education and health intervention programs (Skinner et al., 2015). In a review by Trifiletti, Gielen, Sleet, and Hopkins (2005), the HBM was applied in 14 out of 44 studies concerned with prevention of unintentional injuries.

The HBM was developed from learning theories, combined with cognitive reasoning, to explain how thinking and reasoning can provide determining factors to an individual's readiness to change a behavior (Skinner et al., 2015). Prior to the 1950s, social psychologists explained human behavior using either stimulus-response theories or cognitive theories. Stimulus-response theory suggested that behaviors occurred based on the reinforcement or consequences of the behavior. It did not account for reasoning or intellectual decision-making. Social psychologists who supported stimulus-response perspectives believed that human actions were in response to various stimuli. Researchers supporting learning based on cognitive theories proposed that thinking and reasoning are integral to an individual's actions, depending on what outcome the individual values (Skinner et al., 2015; Holland, 2008).

During the early 1900s, tuberculosis (TB) was one of the leading causes of death in the United States and significant public health interventions were implemented in an effort to decrease the incidence of TB (Parmer, Allen, & Walton, 2017). With the development of effective antibiotics to treat TB, chest x-rays were the primary mode of detection of TB. Mobile x-ray vans were used in many different settings as a means of reaching individuals who otherwise may not have had access to diagnosis and treatment (Miller, Lonnroth, Sotgiu, & Migliori, 2017). However, even with free TB screenings available, health care workers found that many individuals chose not to participate. Social psychologists in the U.S. Public Health Service developed the HBM to explain why residents would choose to forego the TB screenings. The HBM is based on the idea that people are more motivated to participate in health behavior programs when they believe they are at risk for the disease or condition (Miller et al., 2017; Skinner et al., 2015).

Constructs of the Health Belief Model

The HBM includes six different constructs that are used to describe an individual's perceptions and attitudes towards the prevention, diagnosis, and/or treatment of health conditions (Skinner et al., 2015). The six constructs are identified as follows:

- Perceived susceptibility – refers to an individual's belief about the likelihood of being affected by a disease or condition;
- Perceived severity – the individual's belief about the seriousness of a disease or condition;
- Perceived benefits – belief about the advantage of a health behavior preventing or reducing the effects of a disease or condition;

- Perceived barriers – the individual's belief about the obstacles or negative consequences of adopting a health behavior;
- Cues to action – internal and/or external signals that trigger an individual to participate in a healthy behavior to prevent, diagnose, or treat a disease or condition;
- Self-efficacy – the individual's beliefs that he/she can complete the recommendations to improve health.

These six constructs have been used to develop health intervention strategies to address potential health conditions such as obesity and diabetes (Abdeyazam, Moshgdar, & Golshiri, 2017; Dehghani-Tafti et al., 2015). Researchers have worked to identify which of the constructs are the strongest predictors of an individual's probability of participating in a health prevention or intervention program. In a review of 18 studies utilizing the HBM, Carpenter (2010) found that the constructs of perceived benefits and perceived barriers were the strongest predictors of whether an individual would participate in a healthy behavior. Evidence suggests that an individual's likelihood of adopting a healthy behavior depends on the type of behavior that is desired. Carpenter (2010) found that perceived benefits and perceived barriers were the strongest predictors when the requested behavior addressed prevention of a health condition, but were not strong predictors of an individual's adherence to a treatment regimen.

Use of the HBM

In an effort to address the prevention of concussion injuries in youth athletes, the HBM has been utilized to determine appropriate intervention strategies for parents to

increase awareness and education of concussions. Using the constructs of the HBM as a template, Patel and Trowbridge (2017) interviewed caregivers of youth athletes, coaches, and athletic trainers. Caregivers responded to questions concerning the source of concussion education they had received, the potential barriers to accessing concussion education, their perceived susceptibility of their child sustaining a sports-related concussion, their perceived seriousness of concussions, and their self-efficacy to recognize the symptoms of a concussion injury. Results of the study indicated that use of the HBM is a viable guide to deliver relevant, trusted education to caregivers of youth athletes in order for the caregivers to make informed decisions regarding their children's safe participation in sports.

In collaboration with the Victorian Health Promotion Foundation, the School of Human Movement and Sport Sciences at the University of Ballarat in Australia (currently Federation University Australia) launched a study to examine parents' perceptions of the risk of sports injuries in their children (Otago et al., 2005). The researchers posited that parents having knowledge about the risk of injury was not enough to elicit preventative action. The study utilized the HBM to construct a survey of 33 questions using a 5-point Likert scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). Parents were asked to rate their perceptions to the questions which addressed the HBM constructs. For example, one question read, "The risk of my child receiving a serious injury is high during competition in athletics." The 33 questions were divided so that six questions looked at perceived susceptibility, six questions examined perceived severity, 10 questions addressed cues to action, five questions addressed perceived barriers, three questions

examined perceived benefits and three questions addressed self-efficacy. An additional five questions on the survey collected demographic information. The surveys were sent to parents with children participating in at least 1 of the 46 sports registered with VicHealth. The wording in the questions were modified to fit each of the sports represented (Otago et al., 2005).

Following return of the surveys, the second phase of the study was implemented in which parents were interviewed via phone to provide qualitative information related to their child's participation in sports. Overall, the parents conceded that there was a risk of injury when their child played sports, but the benefits of participating outweighed the risks. Otago et al. (2005) found that while some parents did try to steer their child towards a sport the parents perceived as low risk, most parents did not prevent their child from participating in a sport perceived as a higher risk for injury (Otago et al., 2005).

Numerous studies have used the HBM to identify the essential factors necessary to maximize participation in healthy behaviors. Researchers continue to examine various health conditions in the context of the HBM constructs to guide health education and intervention programs. The survey utilized in the study by Otago et al. (2005) served as the framework for the survey instrument used in this study to examine parents' perceptions of the risk of concussion injuries in young athletes.

CHAPTER III

METHODOLOGY

Population and Sample

The purpose of this study was to examine parental perceptions of their sons' risk of incurring a concussion injury while participating in select football. The researcher used a paper-pencil survey to collect data from parents of 8 to13-year-old boys playing select football in the DFW area, and each participant received a $5.00 Target store gift card upon completion of the survey. Establishing a personal interaction and requesting the parent to complete the survey provided an increased completion rate (Bolarinwa, 2015). Self-administered surveys are a recognized method to investigate opinions that are not easily observable and may be difficult for individuals to express verbally in face-to-face interviews (Nardi, 2006). IRB approval was received for this mixed-methods study.

The researcher used personal contacts and inquiries to various youth select football leagues to gain access to the schedules of practices and games of select football teams in the DFW area. The current study was conducted in the field by the sole researcher. According to Kontos et al. (2013), the combined incidence rates of concussion injuries for 8 to10 year-olds and 11 to 12-year-olds playing football is 2.72 per 1,000 exposures. This data was used to determine a sample size of 99 to provide sufficient power of .80 (ClinCalc LLC, 2019). The researcher spent approximately 40 hours in the field

traveling to multiple schools and football fields to collect survey data from a convenience sample of parents and caregivers of 8 to13-year-old boys playing select football. The participants were randomly chosen at select football practices and games, and 101 parents/caregivers completed the study survey. Inclement weather over a period of weeks cancelled practices and postponed many of the football games. Thus, data collection occurred during a longer period of time than anticipated (i.e., from the second week of September 2018 through the second week of November 2018).

The participant's zip code of residence was the only identifying information collected to enable the researcher to ensure adequate representation of the various socioeconomic areas within the DFW area.

Instrumentation

After an extensive literature search, the researcher identified the *Parental Perceptions of Sports Injury Risk* developed by Otago et al. (2005) for their report to the Victorian Health Promotion Foundation. This instrument was the only one identified that specifically used the HBM as a theoretical foundation to examine parental perception of their child's injury risk due to sports participation. Otago et al. (2005) developed their instrument to examine injury risk perceptions of parents of youth athletes and analyzed responses from 855 participants. The original survey consisted of 33 Likert-scale questions designed to address parents' perception of their child's injury risk due to participation in 46 possible sports offered in Victoria, Australia. The Likert-scale questions were based on the six constructs of the HBM. The survey instrument used in the current study was adapted from the original survey with the authors' permission (see

Appendix E). The researcher deleted items from the original survey that were not applicable to the current study's research questions (e.g. "The quality of athletics facilities had no influence on my decision to involve my child in athletics," and "Safety procedures inhibit the spontaneity of athletics"). The researcher modified the remaining 23 questions to specifically examine parents' perceptions related to their sons' risk of incurring a concussion injury while participating in select football. Because Otago et al. (2005) conducted a survey study for a prominent health foundation, their report does not contain information regarding the validity and reliability of specific survey items. However, the authors reported general reliability of survey items to measure the HBM constructs (Otago et al., 2005). Their report provides support for the appropriateness of the instrument to measure parents' perceptions regarding youth athletes' injury risk. A panel of three interdisciplinary professionals familiar with concussion injury also reviewed the survey questions for face validity. The reviewers expressed no concern for face validity of the instrument and deemed the survey questions relevant and appropriate to answer the research questions.

Each Likert-scale question was designed with a five-point Likert-scale (SD = *Strongly Disagree,* D = *Disagree*, N = *Neither Agree or Disagree,* A = *Agree,* SA = *Strongly Agree*) and related to one of the six constructs of the HBM: *perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action,* and *self-efficacy*. Therefore, more than one question corresponded to each of the constructs.

The 23 Likert-scale questions examined parents' perceptions of their sons' perceived susceptibility in experiencing a concussion injury, the perceived severity of concussion injuries, the perceived benefits of playing select football, perceived barriers in playing select football, parents' self-efficacy to prevent and/or recognize the symptoms of a concussion injury, and cues to action that parents perceive as factors enabling their sons to safely participate in select football. These six HBM constructs were the dependent variables in this study. An additional 14 questions provided demographic information and addressed the following independent variables: years of education, experience with concussion education, and parents' experience in sports participation. Five open-ended questions related to parents' knowledge and understanding of concussion injuries were also included in the survey to obtain parents' opinions and feedback regarding concussion education and perceived risks and benefits of their sons playing select football (see Appendix D). The open-ended questions were as follows:

1. What types of concussion injury education strategies or programs do you recommend for parents?
2. What source(s) of concussion injury education do you trust? (Examples: physicians and other medical providers, researchers, athletic trainers, coaches, league directors, other parents, websites, popular media, etc.) List all education sources you trust.
3. What are the benefits of your son's playing select football that outweighs his risk of experiencing a concussion?

4. What recommendations do you have for effectively preventing and responding to concussion injuries in young select football players?
5. What other comments would you like to add?

These questions were answered individually by the parent/caregiver. Recurring themes in the responses to the open-ended questions were identified and the frequency of those responses was tabulated for each question. Utilizing frequency counts provides a means of analyzing qualitative data that further enhances results from quantitative analysis (Chang, Voils, Sandelowski, Hasselblad, & Crandell, 2009).

Procedures

The researcher attended three practices and 15 games throughout the DFW Metroplex over several weeks in the fall of 2018 to collect the data. Participants were parents/caregivers of select football players between 8 and 13 years old and were randomly selected to complete the paper/pencil survey. All participants were provided with the consent form (see Appendix C), and completion of the survey constituted their agreement to participate in the study. Each parent or caregiver was given a clipboard with the survey and a pen attached and completed the survey while the researcher recruited additional participants from the surrounding sidelines or grandstands. The survey took approximately 10-15 minutes to complete. The researcher returned to each participant to collect the completed survey and to provide the participant with the $5.00 Target store gift card in appreciation of their time. Each survey was placed in a manila envelope by the researcher after it was completed.

Treatment of the Data

The survey consisted of 14 demographic questions (nominal data) and 23 questions using Likert-scales to examine parents' perceptions of their sons' risk of incurring a concussion injury in relation to the six constructs of the HBM (ordinal data). Survey data were analyzed utilizing the Windows Statistical Package for the Social Sciences (SPSS®) Version 25. Exploratory factor analysis and Cronbach's *alpha* were used to determine reliability of the scales examining the six constructs of the HBM. Convergent validity was also examined by comparing the related scales in the survey instrument. A mean score and standard deviation for each ordinal-level question was computed and analyzed as the dependent variables. An analysis of variance (ANOVA) was used to examine the relationships between the dependent variables and the independent variables. Correlation analysis was used to examine the relationships between the continuous variables and the independent variables to identify factors that may influence a parent's decision to permit his/her son to participate in select football. Descriptive statistics such as the average age of the parents, how many years their son had been playing football, if the parent had ever played sports, if the parent had ever suffered a concussion, and ethnicity were obtained from the demographic questions. The open-ended questions provided anecdotal information to further investigate parents' perceptions and examine any specific trends.

Summary

A convenience sample of 101 parents/caregivers of 8 to13-year-old boys playing select football in the DFW area were asked to complete a survey examining parents'

perceptions of the risk of their son incurring a concussion injury. Parents and caregivers were provided a clipboard and pen to fill out the paper survey and the participants received a $5.00 Target store gift card upon completion of the survey. The 23 Likert scale questions corresponding to the six constructs of the HBM were examined for reliability using factor analysis and Cronbach's alpha. The survey data were analyzed using descriptive statistics, and ANOVA was utilized to explore the correlations between the independent variables and the dependent variables. Open-ended questions were used to elicit additional feedback and opinions from parents/caregivers concerning available concussion education, benefits and risks of playing select football, and recommendations for preventing and responding to concussion injuries.

CHAPTER IV

RESULTS

The primary purpose of this study was to examine the relationship between parents' educational attainment, previous experience playing sports, knowledge of concussion injuries, and perceived risk of their sons sustaining a concussion injury while participating in select football. A secondary purpose was to explore parents' perceptions about concussion injury education and prevention using open-ended questions.

Demographics

A total of 101 parents participated in the survey. Two parents did not complete the entire survey, so responses from the remaining 99 participants were analyzed. Ages of the parents/guardians ranged from 27 years of age to 56 years. The ages were grouped for purposes of reporting and sixty-nine of the parents were female (69.7%) and 30 were male (30.3%). Age and gender were not variables used in the study but are reported for demographic and discussion purposes (see Table 2).

Table 2

Frequencies and Percents for Age and Gender

Groups	Frequency	Percent
Age		
27-30	13	13.3
31-35	29	30.5
36-40	25	26.3
41-45	11	11.6
46-50	10	10.5
51-56	7	7.3
Gender		
Female	69	69.7
Male	30	30.3

Note. Four participants did not report age

The majority of respondents described their ethnicity as Black or African American (44.4%), followed by White or Caucasian (32.3%), Hispanic or Latino (14.1%), Asian/Pacific Islander (3.0%), and Native American or American Indian (2.0%). Four participants (4.0%) classified their ethnicity as “Other” (see Table 3).

Table 3

Frequencies and Percents of Ethnicity

Groups	Frequency	Percent
Black or African American	44	44.4
White	32	32.3
Hispanic or Latino	14	14.1
Asian/Pacific Islander	3	3.0
Native American or American Indian	2	2.0
Other	4	4.0

Participants from twenty-eight zipcodes throughout the Dallas-Fort Worth Metroplex completed the survey.

Information was gathered from the survey for the independent variables pertaining to the level of education attained by the parents, whether or not the parent had received concussion education, and if the parent had participated in sports. Participants indicated that 36.4% had received some college education, 26.3% held a Bachelor's degree, and 19.2% had completed high school or less. Parents who had completed graduate courses represented eighteen percent (18.2%) of the parents completing the survey (see Table 4). When asked if the parent had experience playing organized sports, 80.8% responded that they had played sports at various levels; and 36.4% stated that they had been injured playing in organized sports. Of the 99 participants, 56 responded (56.6%) that they had received concussion education.

Table 4

Frequencies and Percents for Level of Education

Groups	Frequency	Percent
High School or Less	19	19.2
Some College	36	36.4
Bachelor's Degree	26	26.3
Graduate Courses	18	18.2

Data Analysis Results

Preparation of the data was completed to ensure normality and sufficient sample size, and the Statistical Package for the Social Sciences (SPSS®) Version 25 was utilized for data analysis. Bivariate correlation was used to examine the correlation of the Likert scale questions assigned to each of the HB constructs referred to as *subscales* for the purpose of data analysis. A Cronbach's alpha (*a*) score of .70 and above is generally considered acceptable to indicate internal consistency of items on a scale (Field, 2009). Cronbach's alpha was computed for each of the subscales to determine internal consistency of the questions that comprised the specific subscale. Results of the analysis indicated that the subscales of Perceived Susceptibility (Cronbach's a = .25), Perceived Severity (Cronbach's a = .40), Perceived Barriers (Cronbach's a = .26), and Cues to Action (Cronbach's a = .48) did not demonstrate adequate internal consistency as Cronbach's alpha values were outside of the acceptable range. The subscales of Perceived Benefits (Cronbach's a = .70) and Self-Efficacy (Cronbach's a = .77) indicated internal consistency (see Table 5).

Table 5

HBM Questions and Corresponding Cronbach's alpha

Perceived Susceptibility	**Cronbach's *a* = .25**
My child is more at risk of a concussion injury during practices than in games.	
Unless my child participates in football at the professional level, the potential for a concussion injury is minimal.	
The more time my child participates in football, the more likely he will receive a concussion injury.	
My child is more at risk of receiving a concussion injury during games than in practices.	
The risk of a concussion injury is a concern as my son gets older and wants to play football.	
Perceived Severity	**Cronbach's *a* = .40**
Serious injury is more likely to occur in sports other than football.	
I do not believe my child is at risk of obtaining a serious concussion injury while playing football.	
Perceived Barriers	**Cronbach's *a* = .26**
It is too costly to provide the safety equipment for my child.	
Information from other parents has <u>not</u> influenced my views on my son playing football.	
If the coaches did not receive concussion education, it would influence my decision regarding my son playing football.	

Perceived Benefits	**Cronbach's *a* = .70**
My son has the potential to play football at the PROFESSIONAL level.	
My son has the potential to play football at the COLLEGE level.	
It is important for my son to have fun playing football.	
Cues to Action	**Cronbach's *a* = .48**
Trained coaches are important to reduce the risk of a concussion injury to my child when playing football.	
More awareness in football regarding concussion injuries have positively impacted my decision to involve my child in playing football.	
My willingness to allow my child to participate in football is influenced by the use of adequate protective equipment	
Self-Efficacy	**Cronbach's *a* = .77**
I am confident that I can recognize the signs of a concussion injury.	
My knowledge of concussion injuries enables me to ensure my child is safe while playing football.	
I feel I have no control over the risk of a concussion injury occurring to my child while playing football.	
I feel I have received adequate education about concussion injuries.	
I am confident that I will intervene if the coach doesn't recognize the signs and symptoms of a concussion injury in my son.	
I am confident that I know the best treatment for my son if he should sustain a concussion injury.	

A reason for the lack of internal consistency within the subscales may be that there were 33 questions in the original study by Otago et al. (2005). In the current study, the researcher presented the survey face-to-face with the participants. In an effort to keep the total length of the survey to 10-15 minutes to complete, 23 of the Likert scale questions were utilized and represented the six constructs in the HBM. However, this reduced the number of questions in each of the subscales. The subscale of perceived severity had only two questions measuring this construct, and the subscales of perceived benefits, cues to action, and perceived barriers had three questions in each one. There were five questions measuring perceived susceptibility and seven questions measuring the self-efficacy construct. Thus, there may not have been a sufficient number of questions to adequately measure the internal consistency of each sub-scale.

The original survey was designed to measure parental risk perceptions of their children participating in *all* sports activities. In adapting the questions for this study to focus on parental risk perceptions of concussion injuries in preadolescent boys playing select football, the individual questions may have been grouped in such a way that they did not accurately represent the HBM constructs. This may be another reason for the lack of internal consistency in the subscales.

Each of the independent variables of parental educational attainment, concussion education received by parents, and parents' experience in sports participation were analyzed using multiple ANOVAs to examine the independent variables' effect on the dependent variables of the subscales. With the use of multiple ANOVAs, there is an increased chance of a familywise error, or type 1 error, occurring. A type 1 error can

occur when analysis of the data is misinterpreted and the null hypothesis is not retained. This means that the data is interpreted as the independent variables having a direct effect on the dependent variables when in actuality there is no direct effect. Computation of the familywise error resulted in a 26% possibility of a type I error occurring using a significance value of $p < .05$. To address this issue, each individual ANOVA significance value was set at $p < .01$. A MANOVA was not used to examine the effects on the dependent variables secondary to the lack of correlation between the items on the subscales. Because the items on the subscales are based on the six constructs of the Health Belief model, the questions on the subscales cannot be combined in random combinations.

Table 6 outlines findings of one-way ANOVAs conducted to examine the effect of parents' level of education on each of the subscales representing the HBM constructs. Results indicated that the level of education attained by the parent did not have an effect on any of the subscales (see Table 6).

Table 6

Effect of Parent Level of Education on Health Belief Constructs

Variable	*n*	*M*	*SD*	*F*	*p*	η^2_p
Perceived Susceptibility				1.85	.14	.06
High school or less	19	3.35	.55			
Some college	36	3.36	.43			
Bachelor's degree	26	3.63	.50			
Graduate courses	18	3.39	.59			
Perceived Severity				1.47	.23	.04
High school or less	19	3.18	.89			
Some college	36	3.49	.70			
Bachelor's degree	26	3.58	.82			
Graduate courses	18	3.70	.79			
P**erceived Benefits**				3.38	.02	.10
High school or less	19	4.11	.70			
Some college	36	4.05	.72			
Bachelor's degree	26	3.63	.89			
Graduate courses	18	3.50	.79			
Perceived Barriers				1.68	.18	.05
High school or less	19	2.75	.77			
Some college	36	2.54	.59			
Bachelor's degree	26	2.50	.43			
Graduate courses	18	2.90	.67			

Table 6 (Continued)

Effect of Parent Level of Education on Health Belief Construct

Variable	*n*	*M*	*SD*	*F*	*p*	η^2_p
Self-Efficacy				2.35	.08	.07
High school or less	19	3.39	.88			
Some college	36	3.68	.60			
Bachelor's degree	26	3.77	.56			
Graduate courses	18	3.33	.67			
Cues to Action				.47	.70	.02
High school or less	19	3.88	.58			
Some college	36	4.05	.51			
Bachelor's degree	26	3.93	.62			
Graduate courses	18	3.94	.56			

The data was then analyzed to determine the presence of any effects on the subscales between parents that had received concussion education and the parents that had not received concussion education. There was not a significant effect of the presence or absence of concussion education on the subscales of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. However, there was a significant effect of concussion education on *self-efficacy.* Results indicated that the groups differed on the mean *self-efficacy*, t (97) = 5.97, $p < .001$, d = 1.20 (see Table 7).

Table 7

Parents' completion of concussion education? (Yes or No)	*M*	*SD*	*t*	*p*	*d*
Perceived Susceptibility					
Yes	3.42	.50	-.25	.80	.05
No	3.45	.53			
Perceived Severity					
Yes	3.48	.85	-.11	.80	.02
No	3.50	.72			
Perceived Benefits					
Yes	3.90	.84	.65	.52	.13
No	3.80	.76			
Perceived Barriers					
Yes	2.52	.56	-2.16	.03	.43
No	2.78	.66			
Self-Efficacy					
Yes	**3.90**	**.55**	**5.97**	**.00**	**1.20**
No	**3.19**	**.63**			
Cues to Action					
Yes	4.07	.56	2.08	.04	.43
No	3.84	.53			

Analysis was then completed to examine whether the parents' participation in organized sports had any effect on the six subscales. An independent samples *t*-test was utilized to compare the means of the independent variable and the subscales, and no significant effect was apparent on any of the subscales (see Table 8).

Table 8

Parents' participation in organized sports? (Yes or No)	*M*	*SD*	*t*	*p*	*d*
Perceived Susceptibility					
Yes	3.49	.52	2.16	.08	.60
No	3.21	.37			
Perceived Severity					
Yes	3.56	.80	1.90	.52	.51
No	3.18	.69			
Perceived Benefits					
Yes	3.86	.79	.26	.33	.06
No	3.80	.88			
Perceived Barriers					
Yes	2.63	.61	-.15	.57	.04
No	2.65	.64			
Self-Efficacy					
Yes	3.63	.66	1.46	.88	.36
No	3.38	.72			
Cues to Action					
Yes	4.03	.55	2.21	.64	.56
No	3.72	.55			

Qualitative Analysis

Open-ended questions in the survey were utilized to provide qualitative data to examine parents' perceptions about concussion injury risk and concussion injury education and prevention. The final four research questions included:

- What types of concussion education strategies/programs do parents recommend?
- What source(s) of concussion injury education do parents trust?
- What do parents perceive as benefits of their sons playing select football that outweigh the risks of experiencing concussion injury?
- What are parents' recommendations for preventing and responding to concussion injuries in young select football players?

The parents' responses to the open-ended questions were analyzed by identifying common themes in the responses to each question and obtaining a frequency count of each of those themes. The five most occurring themes for each question are reported and provide insight into parents' beliefs and opinions regarding their sons playing select football and their recommendations for education of, and management of, concussion injuries. Not all participants responded to all questions, however, responses for each question often totaled more than the number of participants completing the survey (99) as the respondents often provided more than one response. Example of participants' responses and discussion of each question are provided in Chapter V.

The first open-ended question on the survey asked, "What types of **concussion injury education** strategies or programs do you recommend for parents? Please be

specific." Of the 85 participants that responded to this question, the majority of respondents identified "online programs" as the primary recommendation for concussion injury education strategies or programs. It is noteworthy that "classes" and "written materials" were also identified in the most occurring responses as well as "Don't know of any" which supports the finding that identifying the preferred format of concussion education programs is key in increasing awareness of concussion injuries (see Figure 2).

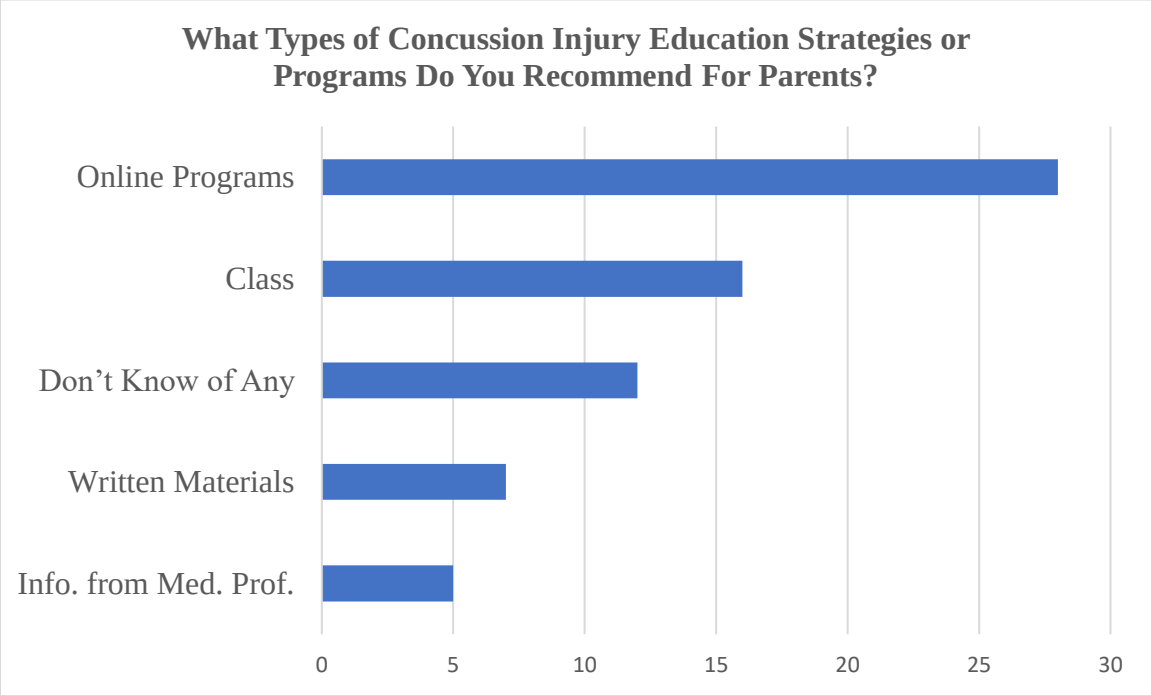

Figure 2.

Most Frequently Identified Concussion Injury Education Strategies/Programs

The second open-ended question on the survey addressed the participants' opinions regarding the most trusted sources of concussion education and it asked, "What **source(s) of concussion injury education** do you trust? (Examples: physicians and

other medical providers, researchers, athletic trainers, coaches, league directors, other parents, popular media, etc.) List all education sources you trust." The number of respondents to this question was 93 and the response provided by the majority of participants was "physicians" followed by "athletic trainers" (see Figure 3).

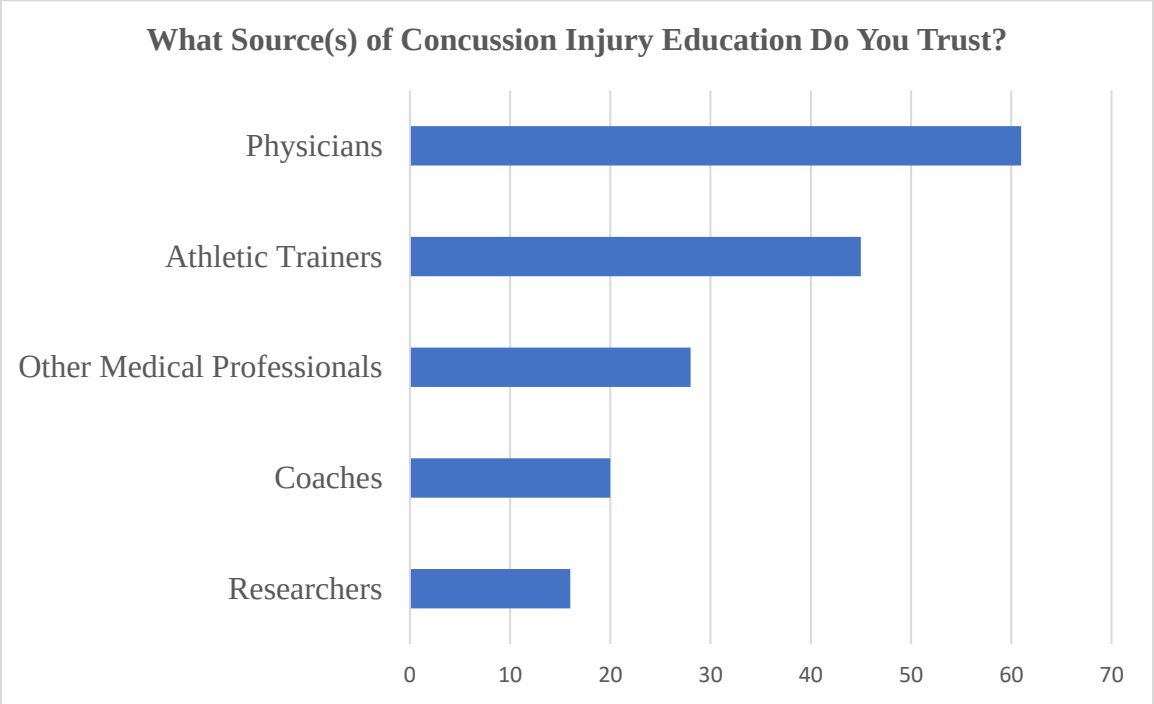

Figure 3.

Most Frequently Identified Source of Concussion Injury Education

Exploring parents' perceptions of benefits of their sons playing select football was addressed in the third open-ended question, "What are the benefits of your son's playing select football that outweighs his risk of experiencing a concussion?" A wide variety of responses were provided by 88 participants. "Fun," "skill development," "physical activity," and "team building" were frequently identified responses, as well as "there is

no benefit." Although not identified in the top five themes, it was noted that five participants responded that the possibility of their son receiving a college scholarship or playing at the professional level was a benefit of playing select football. The participants' responses provide evidence that there are many, and varied, reasons for parents to have their sons participate in select football (see Figure 4).

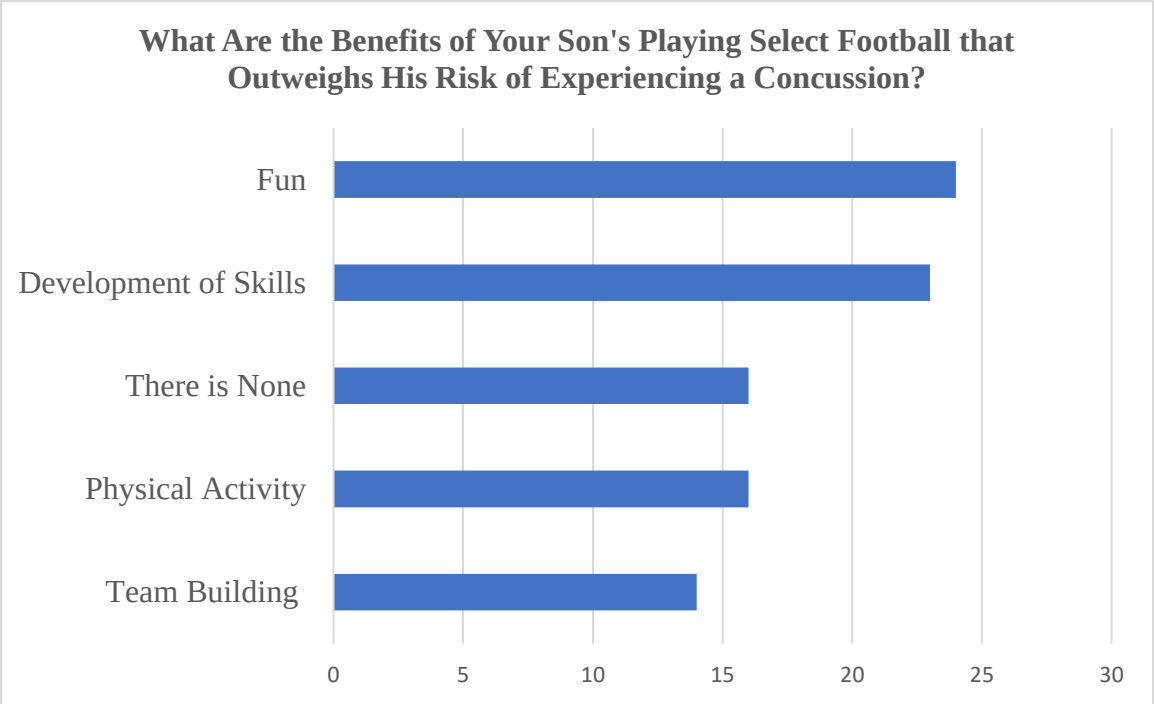

Figure 4.

Most Frequently Identified Benefits of Playing Select Football

The last open-ended question used for analysis asked, "What recommendations do you have for effectively preventing and responding to concussion injuries in young select football players?" Of the 89 participants who responded to the question, the most

frequent response was “concussion education.” Access to safer, more affordable equipment, and proper training for the players were also identified as frequent responses. It is again noteworthy that ten participants responded that they did not know of anything to recommend, highlighting the disparity between parents that are aware of concussion education and those parents that are not familiar with any concussion education strategies or programs. These results are further discussed in Chapter V (see Figure 5).

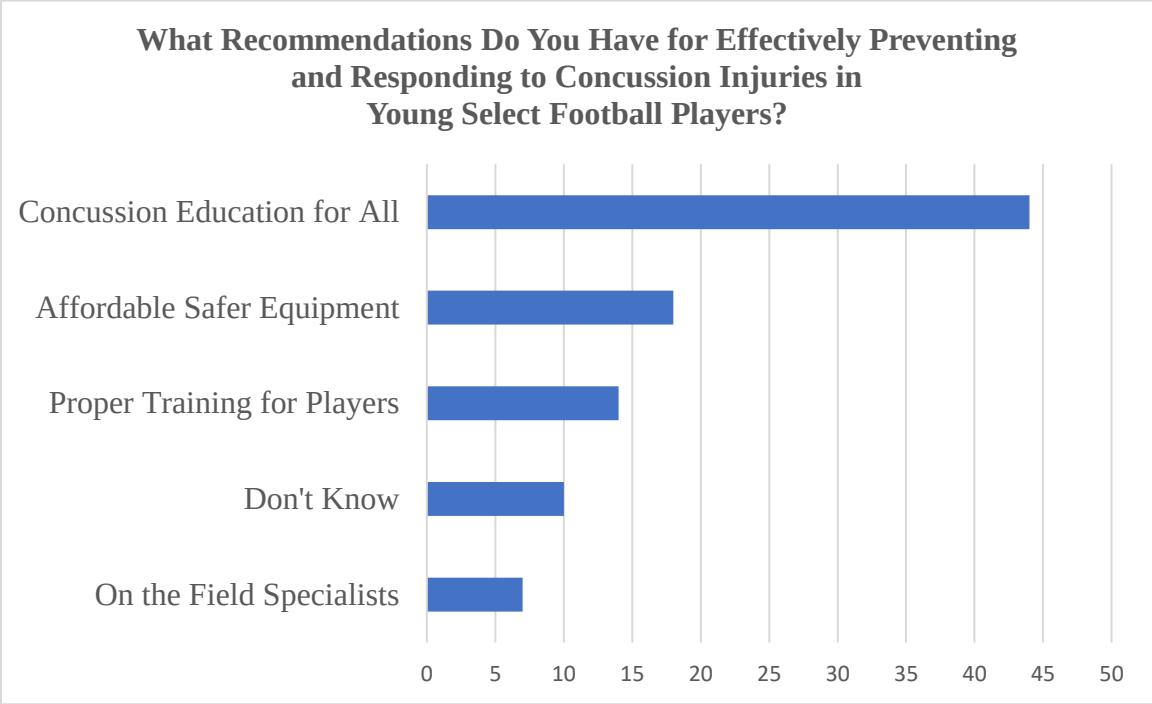

Figure 5.

Most Frequently Identified Recommendations for Preventing and Responding to Concussion Injuries in Young Select Football Players

Summary of Results

Historically, youth sports have attracted a diverse gathering of families. Demographic information indicated that 19.2% of the participants had completed high school or less, 35.4% had received some college education, 26.3% of participants had attained a Bachelor's degree, and 18.2% reported they had completed some graduate courses. Fifty-six percent of the respondents reported they had received concussion education in some format, and 80.8% stated they had participated in competitive sports. Statistical findings indicated that whether parents had received concussion education (yes or no) was the only independent variable that had a significant effect on one of the subscales; in this case, the significant effect was found for self-efficacy.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary

This mixed-methods study examined parents' perceptions concerning the risk of concussion injury in 8 to13-year-old boys playing select football. The study targeted two objectives: (a) to investigate the link between parents' educational attainment, previous experience playing sports, and knowledge of concussion injuries, in relation to the perceived risk of their sons sustaining a concussion injury while participating in select football; and (b) to explore parents' perceptions about concussion injury risk and concussion injury education and prevention. The survey used in the study was adapted from the *Parental Perceptions of Risk of Concussion Injuries* (Otago et al., 2005). Personal contact with participants was made by the researcher at football games and practices. The survey was self-administered by 101 parents/caregivers of 8 to13-year-old boys playing select football in the DFW area. The survey consisted of 23 Likert-scale questions that examined parents' perception of risk of concussion injuries based on the six constructs of the HBM. An additional 14 questions provided demographic information. Open-ended questions were included to elicit parents' responses related to concussions and concussion education and were analyzed using frequency counts of recurring themes of responses to provide qualitative analysis and to further augment the quantitative data provided by the participants.

Research Questions and Hypotheses

The following discussion examines the results of the study's research questions and hypotheses. There were five research questions addressed in the study. The first question examined the effects of parents' level of education attainment, previous experience playing sports, and knowledge of concussion injuries on the parents' perceived risk of their sons sustaining a concussion injury. The other four research questions utilized open-ended questions to explore parents' perceptions and opinions about concussion education and prevention. These responses were not analyzed as qualitative data but to provide anecdotal information to enrich study results.

Research Question 1: Is there a relationship between parental educational attainment, concussion education received by parents, parents' experience in sports participation, and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self - Efficacy, and Cues to Action)?

The Likert-scale questions on the survey were categorized based on the six constructs of the HBM and formed the subscales used for the purpose of this study. Cronbach's alpha was computed for each of the survey's subscales to determine internal consistency. The subscales of perceived benefits and self-efficacy were the only two subscales that demonstrated internal reliability. The original survey used in the study by Otago et al. (2005) was comprised of 33 questions grouped by HBM constructs, and the surveys were mailed to potential participants. For this study, the number of questions pertaining to the HBM constructs was 23 in order to administer questions pertaining specifically to football and the research questions, and to keep the amount of time

required to complete the survey to 10-15 minutes. This modification was primarily used to boost study participation as parents completed the survey on-site at select football games and practices and therefore had limited time. Reducing the number of survey questions decreased the number of questions pertaining to each of the subscales, which likely affected the internal reliability of the subscales. Perceived benefits and self-efficacy, the two subscales with a Cronbach's alpha consistent with internal reliability, had the most questions pertaining to each subscale with five questions concerned with perceived benefits and seven questions related to self-efficacy.

The wording of the survey questions also may have affected internal reliability. The original survey was designed to measure parental risk perceptions of their children participating in *all* sports activities. In adapting the questions for this study to focus on parental risk perceptions of concussion injuries in preadolescent boys playing select football, the individual questions may have been worded in such a way that did not accurately represent the HBM constructs. Although expert review deemed the questions to be clearly worded and possess face validity, the individual questions may not have effectively measured the constructs they were intended to measure.

Multiple ANOVAs were utilized to evaluate the relationships between the independent variables of parents' educational attainment, previous experience playing sports, and knowledge of concussion injuries with the dependent variables of perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, and self-efficacy. Analysis of the data indicated receipt of concussion education was the only independent variable with a significant effect on a dependent variable, which was

the subscale of self-efficacy. This important finding reveals that concussion education increases parents' confidence to recognize and seek treatment for their child suffering a concussion injury. As the majority of coaches in youth football are volunteers, they may not receive any formal training regarding concussion injuries. Therefore, it is of utmost importance for parents to assume the responsibility of being knowledgeable about concussion injuries and confident to intervene on their child's behalf (Glang et al., 2010; Karlin, 2011; Register-Mihalik et al., 2018).

The lack of relationship between the independent variables and the other subscales may be attributed to several factors. Parents' understanding of the survey questions and their personal experiences may have affected their responses. For example, when responding to the item "I feel I have received adequate education about concussion injuries," parents/caregivers may have held different opinions about what "adequate education" means. Some parents/caregivers may believe that reading a handout about concussions is sufficient, while others may feel that an online course regarding concussions should be the minimum to be considered "adequate education." When using self-administered surveys, participants may answer questions out of order or respond to an item differently because they know what questions come later. This can be a disadvantage of self-administered surveys that can affect study results (Nardi, 2006). In addition, the limited number of questions assigned to each of the HBM subscales reduced the opportunity for the questions to clearly exhibit relationships between the questions assigned to each construct. On the other hand, the lack of significant relationship between the independent variables and the constructs of the HBM may demonstrate that

parental level of education and experience as an athlete do not impact parents' perceived risk of their child suffering a concussion. These relationships remain unclear, as there is a paucity of research examining parental variables on the acquisition and/or effectiveness of concussion education. A study by Kay et al. (2017) examined whether parents' history of a concussion injury was a predictor of concussion recognition and the researchers found no correlation.

The first research question in this study provided the basis for the following hypotheses:

Hypothesis 1: There will be no significant relationship between parental educational attainment and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self - Efficacy, and Cues to Action).

Hypothesis 2: There will be no significant relationship between receipt of concussion education by parents and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self -Efficacy, and Cues to Action).

Hypothesis 3: There will be no significant relationship between parents' experience in sports participation and the key constructs of the health belief model (Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Self -Efficacy, and Cues to Action).

Results of the study on the null hypotheses are summarized in Table 9. The receipt of concussion education was the only independent variable that had a significant

effect on an HBM construct, which was self-efficacy. This finding emphasizes the importance of concussion education positively affecting parents' confidence in their ability to recognize the signs and symptoms of concussion and advocate on their child's behalf for appropriate management of concussion.

Table 9

Null Hypotheses Summary: Rejected or Not Rejected

Null Hypotheses	Rejected or Not Rejected
A. There will be no significant relationship between parental educational attainment and the constructs of the HBM.	
Perceived Susceptibility	Not Rejected
Perceived Severity	Not Rejected
Perceived Benefits	Not Rejected
Perceived Barriers	Not Rejected
Self-Efficacy	Not Rejected
Cues to Action	Not Rejected
B. There will be no significant relationship between receipt of concussion education and the constructs of the HBM.	
Perceived Susceptibility	Not Rejected
Perceived Severity	Not Rejected
Perceived Benefits	Not Rejected
Perceived Barriers	Not Rejected
Self-Efficacy	**Rejected**
Cues to Action	Not Rejected
C. There will be no significant relationship between parents' experience in sports participation and the constructs of the HBM.	
Perceived Susceptibility	Not Rejected
Perceived Severity	Not Rejected
Perceived Benefits	Not Rejected
Perceived Barriers	Not Rejected
Self-Efficacy	Not Rejected
Cues to Action	Not Rejected

Research Question 2: What types of concussion education strategies/programs do parents recommend?

Examples of responses included the following:

- "I am not aware of any programs. I rely on placing my son on a team with good coaches that teach proper techniques. I always buy the best helmet for concussions as rated on the internet."
- "Look online on YouTube and google. Also ask primary care provider."
- "Signs to look for, a class with examples of what kids act like after a concussion."
- "A beginning of the season training for parents and kids, educational packets for kids and parents."
- "Talk to other parents, talk to the specialists, don't go to the ER. Have your son work with strengthening coach to strengthen the neck and work on correct tackling and landing."
- "Online training for parents and kids. Certification for coach."
- "Online learning followed by test which they need to pass at 80% or better before the child can play each year."
- "The programs at parent meetings before the season starts."
- "I just simply believe that during practice, literature and a group discussion should be provided on safety and football."
- "Videos for parents and coaches on a weekly basis"
- "At least the club recommended literature and programs"

- "I think internet education with signs and symptoms would be helpful. Recommended treatment"
- "Don't know about any of it to recommend anything."
- "YouTube videos"
- "Educate the coaches enough for them to educate the parents"
- "Videos, classes, and handouts would be very helpful to help educate parents of concussions."
- "Knowing the signs, knowing if your child has hit his head or been hit on the head, keep a close eye on son and seek medical attention ASAP."
- "I do not know of any concussion injury education strategies/programs that exist beyond parents knowing how to conduct and critically appraise current literature (peer-reviewed)."
- "Any is welcome. Videos and more info or access to info."
- "Everyone from parents to coaches and team moms should have an educated pro teach classes of awareness as well as CPR."
- "I don't know. I myself need to learn more on the subject."

Although concussion injury is a real threat to the safety and well-being of young select football players (CDC, 2019a; Harmon et al., 2019; Moore et al., 2018), this study revealed that some parents have not participated in any type of concussion education. While some parents suggested YouTube videos and online training, other parents preferred in-person training from medical personnel or coaches with concussion injury training. Matching parents' preferred format with the concussion education is essential to

the parents' comprehension and retention of the material. Posner, Hawkins, Garcia-Espana, and Durbin (2004) found that parents/caregivers demonstrated improved home safety practices when ED personnel provided face-to-face instructions paired with written materials as opposed to written materials only. Similar results were observed in a randomized study at Cincinnati Children's Hospital in which parents/caregivers were provided with either in-person education in the ED or with education provided on a computerized kiosk. A follow-up evaluation revealed that parents receiving in-person education exhibited an 8.3% increase in home safety behavior compared to 1% increase in home safety behavior among the group receiving education information via the computerized kiosk (Gittelman, Pomerantz, McClanahan, Damon, & Ho, 2014).

While it is estimated that there are over 312 million Internet users in the United States, there are still individuals in the US who do not use the Internet (Statista, 2019; Pew Research, 2019). Pew Research (2019) reported that in 2019, 84% of high school graduates used the Internet while 95% of individuals with some college courses used the Internet. This number decreased to 71% for adults who did not graduate from high school. Internet use is also associated with income level with surveys showing Internet use at 98% for households with an income of at least $75,000 and dropping to 82% for households with an income of less than $30,000 (Pew Research, 2019). Home access to the Internet is also dependent on factors such as location and household income level. Seventy-seven percent of adults between the ages of 30 and 49 had access to the Internet in their home in 2019 (Pew Research, 2019). Other sources of information included TV, social media, and news articles (Patel & Trowbridge, 2017). These findings further

highlight the importance of providing concussion education in a variety of formats to meet the needs and preferences of parents/caregivers with diverse backgrounds.

Efforts to identify factors affecting the effectiveness of concussion education have been initiated by various organizations and researchers. In a study supported by the CDC, Bloodgood et al. (2013) examined concussion knowledge among parents and youth athletes to determine the needs for additional programs and materials to provide concussion education. Online surveys were administered to approximately 125 young athletes between the ages of 13 and 15, and 125 athletes between 16 and 18 years old. Parents of children between 5 and 18 years of age were divided into groups of 100 parents per age group based on their child's age (5-9 years, 10-13 year, and 14-18 years) and were asked to complete an online survey related to concussion injuries. While 85% of all parents had "heard about concussions," this decreased to 72% in parents whose oldest child was between 5 and 9 years old. The rate of concussion awareness further decreased to approximately 20% in younger parents aged 18-25. Parents of children between 10 and 13 years old (77%) responded that concussions are a critical issue compared to 40% of parents of the 5 to9-year-old children and 56% of the children between 14 and 18 years of age. Of the 13 to15-year-old youth participants who responded, 54% reported that concussions are a critical issue, while 34% of the 16 to18-year-old youth believed that concussions were an issue. In another study, Gourley et al. (2010) surveyed 100 parents (39 males, 61 females) of youth athletes aged 10-14 regarding concussion education and found approximately 80% of parents were able to identify common signs and symptoms of concussion; however, fewer than 70% were able

to identify other possible symptoms or proper management of concussion, such as removing the athlete from play. These results emphasize the need for further concussion education programs and strategies to provide information to parents/caregivers and youth athletes. It is of particular importance that parents of youth athletes (5-14 years old) receive concussion education because both parents and athletes may not understand the signs, symptoms, and implications of a concussion injury (Hirst et al., 2018; Moore et al., 2018).

Research Question 3: What source(s) of concussion injury education do parents trust?

The next open-ended survey question asked, "What source(s) of concussion injury education do you trust? (Examples: physicians and other medical providers, researchers, athletic trainers, coaches, league directors, other parents, websites, popular media, etc.) List all education sources you trust." Responses from participants included the following:

- "Trainers and physicians. I have been lucky to place my children on teams with former athletes for coaches. They practice and teach proper techniques."
- "athletic trainers, physicians"
- "Doctors/physical trainers/coaches with certifications"
- "Most of books, research, videos"
- "Doctors, Concussion Specialist"
- "physicians, medical providers, athletic trainers, coaches"
- "physicians, trainers, other parents whose child has had one"

- "I prefer a doctor and trainers. Anyone that specializes in TBI, concussions, etc."
- "Website – medical, peer reviewed – not run by sports group written handout checklist"
- "Don't know about any of it to recommend anything."
- "I would trust physicians or coaches who are actually trained to provide information"
- "Athletic trainers & medical providers"
- "Protocols based on systematic review/meta-analysis of peer reviewed studies"
- "Physicians, physical therapists"
- "I'll listen to all sources and make my determination after I take in the information."
- "I trust my son's doctor, coaches, league directors and me. The workshops and videos that I have watched was [sic] very helpful."
- "Do not know any"
- "Trust none"

The responses show a gamut of sources parents trust for concussion information. Most parents listed physicians as one of their primary sources of information, while other participants listed the Internet, coaches, and other parents as trusted resources for concussion education. In addition, some parents were not quite sure. For example, as one parent stated, "All of the above. There is so much information out there." Other

parents stated that they did not know of any trusted sources for information about concussion.

There is a dearth of research concerning parents' use of concussion education resources. In one study, Patel and Trowbridge (2017) examined various sources of concussion education for parents/caregivers. The parents had children between 3 and 23 years of age who participated in various sports including basketball, football, soccer, baseball, cheerleading, gymnastics, volleyball, softball, swimming, and water polo. Individual and small group interviews with 2-3 parents were completed in person or by phone by the researchers. Interview questions were based on the constructs of the HBM and targeted the following areas: perceived susceptibility and severity of sports-related concussions; parental/caregiver knowledge about concussions and how to appropriately respond if their child sustained a concussion; perceived benefits and barriers to prevent sports-related concussions and follow treatment protocols; receipt of any educational materials related to concussion and any other cues to action; and preferred sources of information about sports-related concussions. Results indicated that parents often did not seek concussion education if their child had not sustained a concussion.

Some parents reported that even though they may have received some education about concussions, their perceptions about the risk of severity increased when they heard stories in the media about NFL or collegiate players particularly those involving the long-term effects of concussion injuries. The sources that parents identified as providing trusted concussion education were physicians, some specialists, and the athletic trainer (if

the parent felt they had a good relationship with the trainer). Other sources included TV, social media, and news articles. Interestingly, many of the parents stated that they did not trust coaches to provide concussion information because they believed that coaches might be biased towards winning and thus not able to provide honest information about concussion injuries and management (Patel & Trowbridge, 2017). The researchers discovered that to ensure the caregivers of youth focused on the concussion information, the material needs to be provided in a preferred format by a trusted source. The researchers also found that too much information or information presented in a non-preferred format were perceived as barriers to message effectiveness (Patel & Trowbridge, 2017) and this finding was supported in the current study.

Concussion education resources are available in various formats and target specific audiences. For example, the CDC offers a "Heads Up: Concussion in Youth Sports" (2019c) program that provides concussion education materials for coaches, officials, medical personnel, parents, and athletes. Topics include concussion signs, symptoms, and management of concussion. Covassin et al. (2012) studied the effectiveness of the "Heads Up" program with 340 youth sport coaches who had an average of 7.8 years of coaching experience in a variety of sports including football, soccer, softball, basketball, cheerleading, baseball, and volleyball. Nearly one-fourth (24%) of the coaches reported one of their athletes had a concussion injury during the previous competitive season. All of the coaches used the "Head Up" program materials for approximately six months before they completed a 22-item survey. The researchers found that 77% of the youth coaches reported being better able to identify possible

concussion injuries in an athlete; and 71.7% of the coaches reported that they were now providing concussion education to athletes, parents, and other coaches after reviewing the "Heads Up" program materials. Of the coaches surveyed, 69% reported not having access to any other concussion education materials before receiving the "Heads Up" information. Overall, Covassin et al. (2012) found the "Heads Up" program an effective tool to provide education to youth sports coaches. In contrast, Glang et al. (2010) found that even when high school and youth coaches were provided with the "Heads Up" information, few coaches actually used the materials. Similarly, Patel and Trowbridge (2017) found that when parents were specifically referred to the CDC (2019d) general site for concussions (https://www.cdc.gov/traumaticbraininjury/), parents reported that they did not consult the CDC site for concussion-related information unless it was determined that their child had suffered a concussion.

Research Question 4: What do parents perceive as benefits of their sons playing select football that outweigh the risks of experiencing a concussion injury? Participants in the study offered the following responses:

- "At this level I believe the risks are equal with any sport. As we move forward, I would evaluate risk vs benefit. As of now I do not see a benefit."
- "Just enjoying himself playing with friends"
- "Fun, Physical Activity, team building, friends, responsibility, commitment"
- "First proper training/education. Trusting the coach and being careful to watch out for symptoms if injury occurs."
- "He loves playing, it's physical activity"

- “Team building, social aspect, working out for health reasons”
- “We had a very healthy experience with football. The friends and physical activity cut our worries.”
- “Exercise, camaraderie, leadership, time management, etc.”
- “Son is learning how to tackle properly. Learning at an early age helps them understand how to tackle.”
- “There are no benefits other than it keeps him active for health purposes.”
- “Teamwork, respect, responsibility, leadership, grit. There is a risk of concussion in many sports besides football, i.e. soccer, basketball, Lacrosse.”
- “No injury is worth or outweighs safety.”
- “Kids are at risk when playing any sport. It is up to us to educate them. If it’s my child’s decision to play sports, I will support them. I want them to have fun and win doing it.”
- “Lots of exercise, team building and dealing with winning and losing.”
- “None”
- “I think the best benefit is my son wearing his equipment at all times and getting proper playing information and training”
- “The more education/ experience they have the less likely hood [sic] of ignoring the signs of an injury.”
- “Conditioning, hard work, dedication, teamwork and fun!”
- “The benefits would be a team sport environment and satisfying his desire to play. There are actually no benefits that outweigh him experiencing a

concussion, but if I do not allow him to play, I feel he would be drawn to more extreme sports."

- "There is a risk for everything, playing sports in general is a risk."
- "Scholarship/possibly Pro (high possibility)"
- "There are none. But for his father's (my husband) allowing him to play he wouldn't. Too dangerous."
- "Education, free college scholarship"

Some parents were not able to identify a benefit of their son playing select football; and if these parents did not write the reason, they verbally told the researcher it was the child's other parent who wanted him to play select football. Other parents indicated that the benefits of exercise, learning teamwork, and having fun outweigh the risk of suffering a concussion injury. Overall, a majority of parents surveyed perceived that the benefits of their son playing football outweigh the risks.

It is recommended for children and youth aged 6-17 to participate in moderate-to-vigorous physical activity for at least 60 minutes per day (U.S. Department of Health and Human Services, 2018). However, the National Physical Activity Plan Alliance (2018) reported a decrease from 35.7% of children and youth aged 6-17 participating in at least 60 minutes per day of moderate-to-vigorous physical activity in 2007 to 28% in 2018. In a summary of the advantages and disadvantages of youth participating in sports programs, Le Menestrel and Perkins (2007) reported that physical activity is probably the number one reason for children of all ages participate in some type of sports program. Additionally, other studies have shown that youth and adolescent sports participation may

also positively impact confidence, resilience, sportsmanship, and leadership (Le Menestrel & Perkins, 2007). Therefore, there are important benefits that children and youth can attain from engaging in physical activity and participating in sports that may offset perceived concussion risk.

Researchers have also examined possible disadvantages of participation in youth sports. The Michigan Study of Adolescent Life Transitions (MSALT) followed approximately 1800 children from sixth grade until they were 25-26 years old. Study results showed that youth who participated in team sports were more likely to partake in risky behaviors such as drinking alcohol by the time they reached high school. However, students who were involved in team sports reported greater enjoyment with school, had a higher GPA through the 12th grade, were more likely to attend college full-time, and were more likely to have a job after graduating from college. Eccles, Barber, Stone, and Hunt (2003) found participation in team sports was a significant predictor of having a job with autonomy by the age of 24.

In a longitudinal study examining the out-of-school activities of 1,357 youths with a mean age of 11 years, researchers found that youth who are involved in extracurricular activities develop increased self-identity and strong morals and learn to value diversity (Zarrett et al., 2009). On the other hand, Zarrett et al. (2009) also found that for some youth, too much time participating in sports actually had a negative effect (e.g., slightly higher rates of depression), which may be attributed to parental pressure to succeed and increased demands on time management. There are also hazards when young athletes are not provided sufficient time to recover between games or practices, resulting in muscle

overuse and other injuries such as heat exhaustion, tendon damage, and sprains. Multiple games and practices can result in excess fatigue and can affect a student's academic performance and overall health and physical development. More research is needed to determine how much exercise is too much for youth and establish effective guidelines to help parents and coaches keep youth athletes safe (Bergeron, 2007; Harmon et al., 2019; Hirst et al., 2018; Moore et al., 2018).

Research Question 5: What are parents' recommendations for preventing and responding to concussion injuries in young select football players?

This question elicited the following responses:

- "Be selective with who coaches your child. Research equipment and spend the money for your child's safety."
- Safety equipment, proper training of how to hit /play. Immediate assessment of all potential injuries."
- "To take them out of the game when you start seeing signs the first time."
- "Making sure coaches and child know how to help prevent injury – accidents do happen. Knowing how to respond and what to do as a parent is very important."
- "Coaches and athletes both need to be certified in concussion awareness and know how to prevent and be aware if someone sustains a concussion."
- "Adult mandatory education from the start, Education on targeting coach, player and parent"
- "Educating the players and parents on concussions"

- “More education for players and coaches”
- “You can’t, it’s impossible”
- “Preventing – hitting correctly. Responding – recognizing symptoms and taking him to the doctor ASAP”
- “Check your son’s helmet before every practice and game for fit. A good helmet should not be something you skimp on.”
- “Make more videos and have more trainings about concussions.”
- “Keep a close eye on athletes in positions that are at increased risk for concussions”
- “Don’t know about any of it to recommend anything.”
- “Just educate all coaches to the extent of a professional”
- “None”
- “Monitor players especially after tackles. It is very important to look out for the young players and choose their well-being than [sic] to make them go back in the games.”
- “Good equipment, good coaching, parents being present”
- “Proper training for all parents in the event that the coaches cannot attend”
- “I feel that each team should be required to have an adult with specialized training that monitors whether certain preventative protocols are being met (both concussive and sub-concussive risk factors) during practice and games, as well as monitors player’s health status/follow-up with a physician should injury occur.”

- "Better helmets with lower prices."
- "Each team needs an athletic trainer. Educated in recognizing concussions."
- "Kids have to be educated. Do not push them too much on being aggressive."
- "Concussions are not always preventable, and do not always occur as a result of football. I was very physical and received a concussion in an accident in which I did not hit my head. A jolt is enough to receive a concussion."
- "I believe that exposure to grants and funding could be passed on to teams to help with purchasing the best protective equipment. Additional training never hurts either."
- "I don't believe there are preventive measures but we should be well educated regarding concussion or anything that could potentially affect my child."
- "I don't have the answers – wish I did."

Responses of the parents confirm the need for concussion education and prevention to be approached from different levels. Parents voiced concerns regarding the expense of equipment, the lack of athletic trainer or medical personnel at practices and games, current rules that do not penalize players for helmet-to-helmet contact, and tackling techniques (e.g., launching the body in front of a ball carrier preventing the defensive player from making adjustments prior to contacting the ball carrier). The majority of parents stated that more concussion education is needed for coaches, parents, officials, and players. Some parents responded they did not know what could be done to prevent concussion injuries.

In the American Medical Society for Sports Medicine position statement on concussion injuries in sports, Harmon et al. (2019) suggested that modification of rules, changes in tackling techniques, and improvement in equipment are all factors that can contribute to prevention of concussion. Harmon et al. (2019) also emphasized that coaches in community sports organizations are typically volunteer parents with little, if any, formal training for coaching. Therefore, concussion education is particularly vital for these coaches to recognize the signs and symptoms of concussions and know how to manage athletes with possible concussion injuries (Glang et al., 2010). Education is the first step, although it is not foolproof. For example, Hirst et al. (2018) found that even when parents are able to recognize the signs and symptoms of concussion, they seek medical attention for their child approximately 50% of the time.

While identification of a concussion injury is difficult, the management of a concussion following diagnosis is often even more challenging. Complete physical and cognitive rest is typically the recommended treatment for concussion, but it is difficult for young athletes to adhere to this recommendation. Additionally, parents and school personnel are hesitant to implement such a strict protocol (Harmon et al., 2019; Karlin, 2011; Moser & Schatz, 2012). Because a concussion injury is not visible, understanding the need to miss school, reschedule tests, allow additional time for completion of assignments, and gradually return to school is often misunderstood. It is imperative that a student who has experienced a concussion avoid returning to school prematurely so that symptoms are not prolonged. This recommendation becomes even more crucial if the student has experienced more than one concussion as research has demonstrated that

athletes who have sustained two or more concussions have a significantly higher risk of exhibiting concussion symptoms for a prolonged period of time (McGrath, 2010; Moore et al., 2018).

Moser and Schatz (2012) described a case of a 14-year-old girl who sustained four concussions within a 13-month period, all while playing basketball. The student was only told not to participate in basketball for two weeks following the first and second concussions. After the third concussion, the student was referred for psychiatric treatment due to her significant emotional and behavioral changes. She was prescribed Zoloft, a medication used to treat depression and anxiety. The student's grades fell considerably; she exhibited memory loss, poor concentration, irritability, fatigue, decreased processing, and reading difficulties. The neuropsychologist then placed the student on two weeks of strict physical and cognitive rest including no school activities during those two weeks. After the period of rest, she returned to school part-time and continued with academic accommodations. Her neuropsychological test scores returned to within-normal limits; and at the end of eight weeks, the student reported feeling "awesome" and was no longer taking Zoloft. Moser and Schatz (2012) used this case as an illustration of the importance of complete rest for the management of a concussion injury. This case example also demonstrates the harm that can result from a lack of awareness and training regarding the identification and treatment of concussion injuries.

Although the final open-ended question was not one of the research questions, the researcher included, "What other comments would you like to add?" to enrich overall study findings. Examples of parent feedback include the following:

- “More education for coaches, refs, parents, league directors seems to be needed. Medical professional present at games”
- “I think people should listen to their child when they tell them they feel bad.”
- “I think there are many qualified doctors/companies that can certify everyone at the location of practice. We need to take advantage of all the education in the world about prevention.”
- “ER doctors need to either refer concussion or be better trained. We were told for our son to be out for practice then he was fine to play.”
- “Penalty for targeting is a positive step.”
- “If you’re worried about concussions then you cannot play football. Plain and simple.”
- “Although the research shows how concussion can occur in football, it is very possible that in every sport played the player risks getting injured. If we can train our young players correctly, we can help prevent or lower concussions in young players.”
- “Parents being present is the key to action after concussion. No sport is safe from injury including concussion protocol in all sports now.”
- “Boys shouldn’t be allowed to play organized football until high school.”
- “I’ve had 3 boys play football and have never had any kind of concussion training or classes. They’ve been playing since 4. They’re 12, 14, 15 now.”

The diversity of responses further illustrates parents’ varied opinions and attitudes towards concussion injuries, including preventative measures to reduce the risk of boys

sustaining a concussion injury while playing select football. A study examining the interaction of various factors on the concussion knowledge of youth athletes found that education targeting specific ages and sports was key to increasing concussion knowledge in youth athletes and parents (Register-Mihalik et al., 2018). Rieger et al. (2018) found that while 86% of parents of 5 to12-year-old youths playing football believed they could recognize the signs and symptoms of a concussion injury, 82% were not familiar with management guidelines, and only 44% knew that continued activity could worsen the symptoms of concussion. In another study, the University of Chicago Pritzker School of Medicine sponsored a survey in which 65% of adults indicated that sports-related concussions are a major issue, regardless of whether they had a child playing sports or not. However, 39% of the participants believed that an MRI or CT scan could be used to diagnose a concussion injury (Taranto et al., 2018). Even when parents had experienced a concussion injury themselves, the parents did not demonstrate increased knowledge of concussion signs and symptoms (Kay et al., 2017). It appears evident that concussion injury education should be provided for parents, coaches, trainers, and athletes to increase competency in the identification and management of concussion injuries.

Limitations

A limitation of this study is that the parents/caregivers who participated in the study reside in the DFW area of Texas; therefore, results cannot be generalized. Demographics of the participants indicated 44% self-identified as Black/African American, 32% White/Caucasian, and 14% Hispanic/Lation. This ethnic distribution is different from the overall ethnicity of DFW with 15.4% of the population

being Black/African American, 46.3% of the population identified as White/Caucasian, and 28.9% identified as Hispanic/Latino (DataUSA, 2017). Although income data was not collected for this study, residential zip codes of the parent/caregiver were recorded as a means of ensuring participants of various socioeconomic levels. For descriptive purposes, the average annual income of each zip code represented was obtained and is reported in Table 10.

Table 10

Average Annual Income by Zip Code

Zip Code	# of participants	Average Annual Income	Zip Code	# of participants	Average Annual Income
75002	11	$122,917	75225	1	$285,679
75013	3	$153,049	75232	4	$47,881
75023	4	$99,019	75454	1	$115,296
75048	3	$104,218	76001	3	$99,919
75052	6	$85,538	76002	3	$96,527
75070	1	$117,767	76010	3	$45,153
75071	1	$111,811	76012	2	$80,642
75074	1	$81,671	76017	2	$84,397
75075	1	$93,946	76018	5	$74,921
75098	4	$97,392	76063	8	$111,645
75115	4	$78,602	76120	2	$58,658
75116	4	$58,344	76123	3	$91,787
75137	4	$73,855	76132	5	$83,640
76134	4	$55,720	76133	7	$64,266

(Cubit Planning Inc., 2019)

Additionally, the lack of internal reliability in the survey questions related to four of the six HBM constructs may limit the conclusions drawn from the survey results. As discussed in Chapter IV, the decreased number of questions categorized into each of the six constructs negatively affected the internal reliability. While more items can increase

the internal reliability of a questionnaire, participants are also less likely to complete an extended questionnaire. Therefore, a brief survey can result in increased participation and thoroughness of responses that can provide enriched data (Bolarinwa, 2015). In this study, the participants were personally asked by the researcher to complete the survey while attending their sons' football game or practice. It was paramount for the survey to be completed in 10-15 minutes to maximize participation and completion of the survey. Hence, using a brief survey was the best choice for this type of study. Despite these limitations, this study provided valuable insight into parents' perception of risk of their sons incurring a concussion injury while playing select football. Results confirmed a need for ongoing concussion education for parents/caregivers from trusted sources in the preferred format. In addition, it is important to recognize that too much information can be perceived as a barrier.

Implications of the Study

The varied mechanisms involved in concussion injuries are not fully understood, and there is limited research and knowledge related to concussion injuries and young athletes. The use of parent volunteers as coaches and the lack of athletic trainers and medical personnel on site at organized youth football practices and games inherently raises questions regarding the actual prevalence of concussion injuries among young athletes. Opportunities for continuing education are important to provide parents and athletes information regarding the importance of recognizing signs and symptoms of concussion as well as understanding the management of a concussion injury. The current

study confirmed that parents identified a wide range of sources to obtain information about concussions, yet many parents do not actively seek information about concussions.

There is also a significant gap in concussion education provided to teachers. It has been well-documented that children who have suffered a concussion injury may experience difficulty at school with attention, reading, processing of information, memory recall, and other cognitive skills (Harmon et al., 2019; Karlin, 2011; McGrath, 2010). Teachers are rarely identified as recipients of concussion education, yet a teacher may be the first person to identify that a child is having difficulty or behaving differently. Teachers must also understand the signs and symptoms of concussion injuries in order to provide support in the classroom as the student recovers from the injury and returns to school and play (Harmon et al., 2019; McGrath, 2010).

Implications for Health Educators

This study is significant for health educators in the planning and distribution of concussion education for parents, coaches, athletic trainers, school personnel, medical personnel, and the student athletes. The National Commission for Health Education Credentialing (NCHEC) outlined seven Areas of Responsibility that include competencies and sub-competencies to guide Certified Health Education Specialists in their multiple roles (NCHEC, 2015). The seven Areas of Responsibility are:

I. Assess Needs, Assets, and Capacity for Health Education/Promotion

II. Plan Health Education/Promotion

III. Implement Health Education/Promotion

IV. Conduct Evaluation and Research Related to Health Education/Promotion

V. Administer and Manage Health Education/Promotion

VI. Serve as a Health Education Resource/Promotion Resource Person

VII. Communicate, Promote, and Advocate for Health,

Education/Promotion and the Profession

These seven Areas of Responsibility are supported by the Council on Education for Public Health (CEPH), the national credentialing body that oversees schools and programs of public health (CEPH, n.d.). This organization emphasizes the need for health educators to be involved in the assessment, planning, dissemination, and evaluation of health education programs. The survey responses from the parents in this study demonstrate the complexities involved when planning and providing concussion education to parents. It must be recognized that concussion education cannot be provided using one approach on one occasion, nor can it be assumed that all parents/caregivers will seek information about concussions just because their son is playing football. Those involved with planning and providing concussion education must be open to all forms of education formats, including printed handouts, face-to-face presentations, handbooks, online modules, and recorded audiovisual messages. Furthermore, there are a variety of concussion education sources such as medical personnel, athletic trainers, researchers, coaches, league officials, other parents and community members, and published materials from credible sources (e.g., the CDC). For concussion education to be effective, it is imperative that the parents/caregivers consider the source credible and trusted. Utilizing various formats for health education and ensuring its effectiveness for the target audience is one of the roles of health educators when planning and developing concussion

education programs. The health literacy of the audience may vary significantly and must be taken into consideration. Health literacy is described as an individual's ability "to obtain, process, and understand basic health information and health care services to make appropriate health decisions" (U. S. Department of Health and Human Services, 2009). Factors that affect health literacy include culture, language, content, communication skills, and experiences in health care. There are several strategies available that can be utilized to assess the reading level and difficulty of health education materials (NCHEC, 2015). Planners and providers of concussion education must use these strategies to ensure that the material provided is specific to the audience, and must carefully assess the vocabulary, reading level, and difficulty of the material in order to maximize the effectiveness of the education.

The seven Areas of Responsibility must be utilized to carefully plan concussion education to meet the needs of varied audiences on an ongoing basis. It is important for health education specialists to be included in the assessment, planning, implementation, and evaluation of concussion education programming. In addition, health educators can collaborate with medical personnel, coaches, league officials, and parents to improve access and ensure understanding of training materials, which can lead to increased self-efficacy of parents to recognize signs and symptoms of concussion. Pretesting educational materials with parents can also lead to insights regarding how concussion injury education can target those with different learning styles. Health educators have extensive resources available to assess the needs and capacity of multiple stakeholders to

aid to in the planning, implementation, and evaluation of effective concussion injury prevention programming.

The first Area of Responsibility - Assess the Needs, Assets, and Capacity for Health Education are sub-competencies to "Examine Factors that Influence the Learning Process" and "Examine Factors that Enhance or Compromise the Process of Health Education" (NCHEC, 2015). Completing a thorough assessment of needs and identifying the various factors that positively and negatively impact learner readiness are significant components included in a health educator's assessment. The assessment is the first step before planning and implementing a program to provide concussion education to the different groups of individuals involved in youth sports, such as select football in this study. Once concussion education programs are developed, the health educator can train others to provide education and facilitate implementation of the programs with parent groups, coaches, football leagues, and medical personnel. The health educator is also responsible for developing a plan to analyze the outcomes of the concussion education programs so that changes can be made to better meet the needs of the stakeholders. The inclusion of health educators in the assessment, planning, development, implementation, and evaluation of concussion education programs is an essential step in promoting knowledge, awareness, and behaviors linked with concussion injury prevention and management among young select football players and other youth athletes.

Recommendations for Future Research

Future research opportunities in the area of concussion are vast. Effective, trusted concussion resources must be identified and promoted among target populations so they

can be armed with essential knowledge and self-efficacy to recognize and properly manage concussion injuries. In the current study, many parents identified physicians and athletic trainers as trusted resources. Community engagement that links credible and trustworthy concussion education resources (e.g., professionals from area children's medical centers, pediatric sports centers, and universities) with parents, coaches, school personnel, and sports leagues can make a key difference in concussion injury prevention and management among young select football players and other youth athletes. Determining the most effective method of disseminating information regarding concussion education and management is paramount in order to affect all stakeholders involved with not only select football, but also all youth sports.

In a study by Patel and Trowbridge (2017), findings indicated that parents frequently do not seek out concussion information until after their child sustains a concussion. Research is needed to identify factors that prevent parents from seeking concussion information, and to determine effective practices to influence parents to initiate obtaining concussion education and to confidently advocate for their child's well-being. Without prior knowledge of concussions, parents are not prepared to recognize the signs and symptoms of a concussion and advocate for appropriate management of concussion injuries in young athletes. Parental feedback to the open-ended questions in this study indicated that not all parents had received concussion education. Yet, study findings demonstrated that receiving concussion education affected parent's/caregiver's self-efficacy in the recognition and management of concussion injuries. Therefore, more research is needed to identify the gap between parents', players', and coaches' general

awareness of concussion injury and specific knowledge and skills that can lead to better concussion injury outcomes for young select football players and other youth athletes.

The effects of subconcussive hits are another key area warranting further research. While concussion injuries stem from hits to the head to cause a myriad of symptoms, a subconcussive hit to the head may not result in observable symptoms but nonetheless can cause micro damage to nerves and vessels that, over time, has been found to be a primary cause of CTE (Concussion Legacy Foundation, n.d.). While subconcussive damage is more difficult to identify than effects from concussion injuries, it is important for parents, athletes, and coaches to be aware of the long-term effects of subconcussive hits. Research is needed to determine the types of hits and locations that are most susceptible to subconcussive injuries, and preventative measures that can be implemented to reduce the risk of damage to nerves and tissue. Similarly, determining how much physical activity is "too much" is needed to increase the safety of youth athletes. Developing necessary guidelines and limits for the number of practices and games per week, the number of hours per practice and per day, and the types of drills and activities that can be included in practices is essential to minimizing the risk of injury.

Early identification of concussion injury is another significant research need. Promising studies are being conducted using differential medical testing to help detect effects of concussion. Snyder and Giza (2019) reported that modalities such as diffusion tensor imaging (DTI), functional magnetic resonance imaging (fMRI), cerebral blood flow (CBF) studies, and transcranial-Doppler ultrasound (TCD) are all being explored as a means of detecting concussions and concussion-related effects. The identification of

biomarkers that can detect the presence of changes or disruptions in the autoregulatory systems in the brain may provide evidence of concussive or subconcussive injury to the brain. In addition, a protein found in blood serum labeled ubiquitin C-terminal hydrolase (UCH-L1) has been identified as a potential biomarker due to its sensitivity in detecting intracranial lesions in children (Li, Yu, Sun, & Li, 2015; Snyder & Giza, 2019). Future research may enable physicians to uncover damage to sensitive neural tissue before any physical signs or symptoms are exhibited. All of these measures may further enhance concussion management and treatment options at all ages (Snyder & Giza, 2019).

Furthermore, more research is needed to examine the individual variables that affect a young athlete's response to concussion injury and the recovery process. A clearer understanding of the variances will help researchers and clinicians clarify why some individuals have a better recovery from concussion than others. In turn, concussion injury prevention and management protocols can be established to protect the safety and well-being of youth athletes, particularly those involved in highly competitive sports such as select football.

Conclusions

While this study focused on youth select football, incidence of concussion has been documented in other youth sports including soccer, basketball, rugby, wrestling, lacrosse, and cheerleading (Guskiewicz & Valovich McLeod, 2011; Harmon et al., 2019; O'Keefe et al., 2018). Although the results of this study cannot be generalized to other sports, it can serve as a template of possible parameters to be considered in the education of parents of children playing other sports. The benefits of children playing football and

other sports are numerous and include fun, physical activity, motor skills, confidence, teamwork, social skills, time management, sportsmanship, and leadership. The goal is not to prevent children from playing football. With the support of key stakeholders such as medical personnel, athletic leagues, coaches, teachers, parents, and players, the overall goal is teach children to play safely, and to enjoy the numerous benefits team sports have to offer.

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APPENDIX A

IRB APPROVAL LETTER

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378 email: IRB@twu.edu
https://www.twu.edu/institutional-review-board-irb/

DATE: August 23, 2018

TO: Ms. Kimberly Mory, Health Studies

FROM: Institutional Review Board (IRB) - Denton

Re: Exemption for How Do Parents Really Feel about Concussion Education and the Risk of Concussion Injuries in Young Select Football Players? (Protocol #: 20224)

The above referenced study has been reviewed by the TWU IRB (operating under FWA00000178) and was determined to be exempt from further review.

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. Because a signed consent form is not required for exempt studies, the filing of signatures of participants with the TWU IRB is not necessary.

Although your protocol has been exempted from further IRB review and your protocol file has been closed, any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any adverse events or unanticipated problems. All forms are located on the IRB website. If you have any questions, please contact the TWU IRB.

cc. Dr. George King, Health Studies

Dr. Marilyn Massey-Stokes, Health Studies

Graduate School

APPENDIX B

IRB MODIFICATION APPROVAL

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378 email: IRB@twu.edu
https://www.twu.edu/institutional-review-board-irb/

DATE: October 30, 2019

TO: Ms. Kimberly Mory
Health Promotion & Kinesiology

FROM: Institutional Review Board - Denton

Re: Notification of Approval for Modification for How Do Parents of Preadolescent Football Players Really Feel About Concussion Education and the Risk of Concussion Injuries? (Protocol #: 20224)

The following modification(s) have been approved by the IRB:

The title of the study has changed FROM: *"How Do Parents Really Feel about Concussion Education and the Risk of Concussion Injuries in Young Select Football Players?"* TO: *"How Do Parents of Preadolescent Football Players Really Feel About Concussion Education and the Risk of Concussion Injuries?"*

cc. Dr. Marilyn Massey-Stokes, Health Promotion & Kinesiology

APPENDIX C

PARTICIPANT CONSENT FORM

TEXAS WOMAN'S UNIVERSITY

CONSENT TO PARTICIPATE IN RESEARCH

Title: How Do Parents of Preadolescent Football Players *Really* Feel About Concussion Education and The Risk of Concussion Injuries?

Investigator: Kimberly D. Mory, M.A. kmory@twu.edu (940-898-2024)
Advisor: Marilyn Massey-Stokes, Ed.D. mmasseystokes@twu.edu (940-898-2063)

Purpose of the Research

You are being asked to take part in a research study for Kimberly Mory's dissertation at Texas Woman's University. This research study explores parents' perceptions of concussion education, and their opinions regarding the risks and seriousness of concussion injuries in boys between 8 and 13 years of age playing select football.

Description of Procedures

Parents of 8-13-year-old boys on select football teams will be randomly selected to complete a paper/pencil survey. No identifying information will be collected from the participants. Results of the surveys will be collected and analyzed. *Confidentiality will be protected to the extent that is allowed by law.*

Potential Risks

Minimal risks are anticipated such as the time required to respond to questions may exceed 15 minutes, or a participant may not feel comfortable responding to one or more of the questions on the survey. Participants may withdraw from the study at any time without penalty.

The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

Participation and Benefits

Your participation in this study is completely voluntary. While there is no direct benefit to you for participating in this study, we hope that the information gained from this study will assist us in developing and providing concussion education to parents.

Questions Regarding the Study

If you have any questions about the research study you should ask the researchers; their phone numbers are at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the Texas Woman's University Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at IRB@twu.edu.

APPENDIX D

PERMISSION FROM AUTHOR

Kimberly Mory <kmory@twu.edu> Feb. 6, 2018, 3:28 PM to c.finch

Dear Dr. Finch,

My name is Kimberly Mory and I'm a speech pathologist and clinical faculty member at Texas Woman's University which is in Denton, Texas. I am also working on my doctorate in Health Studies and am planning my dissertation which is examining parental perceptions and knowledge about concussion injuries in boys between 8 and 13 years of age, who play select (also known as club) football. My theoretical framework is using the Health Belief Model. I have read much of the research that you have been involved with looking at the use of theories and models for sport injury prevention.

I came across the report to the Victorian Health Promotion Foundation regarding the Parental Perceptions of Sports Injury Risk Project (2005). I have referenced this report in my prospectus as it provides much support for my study. Your report was remarkably written to address each of the constructs in the Health Belief Model, and I am writing to ask permission to adapt the survey which you and your colleagues used in your study, to address similar questions I am exploring with my targeted population. I am using a survey and focus groups to speak with parents about their sons' participation in football. I assure you that proper references and citations will be used.

Please let me know if you would like further information regarding my study. I have very much appreciated the research that you have done and I look forward to hearing from you. Thank you very much for your time.

Respectfully,

Kimberly Mory

Kimberly Mory, M.A.,CCC-SLP, CHES

Associate Clinical Professor
Undergraduate Coordinator
Department of Communication Sciences and Disorders

Texas Woman's
University
kmory@twu.edu 940-
898-2024

Caroline Finch <c.finch@federation.edu.au> Wed, Feb 7, 2018, 6:06 PM to me

Thank you for your interest in our work. We'd be very happy for you to adapt the survey for your own work.

Caroline

APPENDIX E

STUDY SURVEY

Parental Perceptions of Risk of Concussion Injuries

The completion of this survey constitutes your consent to participate in this research study.

Parental Perceptions of Risk of Concussion Injuries

The purpose of this survey is to understand your perceptions of the risk of your child sustaining a concussion injury while participating in select football.

INFORMATION ABOUT YOUR CHILD

Please answer the following questions about **your child.**

1. How old is your child? _____

2. What is the approximate number of **hours per week** that your child practices football? _____

3. What is the approximate number of **football games** that your child plays in during a regular season? _____

4. How many **months out of the year** does your child play select football? _____

5. How many years has your child played select football? _____

6. Has your child ever sustained a concussion injury in practice or during a game? YES or NO

If **YES**, how was the injury treated?

_____
_____
_____

Did your child miss any school days? YES or NO

If **YES**, how many days did he miss? _____

INFORMATION ABOUT YOURSELF

Please answer the following questions about **yourself.**

7. What is your gender?

MALE FEMALE PREFER NOT TO ANSWER

8. Please tell us your age: _____

9. Please specify your ethnicity:

_____Hispanic or Latino

_____Black or African American

_____Native American or American Indian

_____Asian/Pacific Islander

_____White

_____Other _____

10. What is your relationship to your child?

FATHER MOTHER OTHER_____

11. What is the highest grade you have completed?

☐ Did not complete high school or GED

☐ Completed high school or obtained GED

☐ Completed some college

☐ Completed bachelor's degree

☐ Completed or enrolled in graduate courses

12. Have you ever participated in organized sports? **YES** or **NO**

If **YES,** please indicate the following:

☐ I played sports on a high school team.

☐ I played sports on a college team.

☐ Other than a school team, I have played sports in an organized competitive or recreational league in the past.

☐ I am currently playing sports in an organized league (ex: Men's or Women's League).

13. Have you ever been injured when playing a sport? **YES** or **NO**
If **YES**, in what sport and what was the nature of the injury?

_____

_____

_____

_____

14. Have you ever received any education regarding concussion injuries?

YES or **NO**

If **YES,** was this training presented in one or more of the following formats:

In person, such as at a team meeting or training workshop? **YES** or **NO**

On the Internet, such as a website or YouTube video? **YES** or **NO**

With written materials and handouts? **YES** or **NO**

Approximately how many times have you had education on concussions? _____

Please read each statement below and decide how much you agree or disagree with that statement. **Circle** the response that corresponds to your answer using the following key.

SD = Strongly Disagree **N** = Neither Agree or Disagree

D = Disagree **A** = Agree **SA** = Strongly Agree

15. My child is more at risk of a concussion injury during practices than in games.	**SD**	**D**	**N**	**A**	**SA**
16. I am confident that I can recognize the signs of a concussion injury.	**SD**	**D**	**N**	**A**	**SA**
17. Unless my child participates in football at the professional level, the potential for a concussion injury is minimal.	**SD**	**D**	**N**	**A**	**SA**
18. The more time my child participates in football, the more likely he will receive a concussion injury.	**SD**	**D**	**N**	**A**	**SA**
19. My knowledge of concussion injuries enables me to ensure my child is safe while playing football.	**SD**	**D**	**N**	**A**	**SA**
20. My child is more at risk of receiving a concussion injury during games than in practices.	**SD**	**D**	**N**	**A**	**SA**
21. I feel I have no control over the risk of a concussion injury occurring to my child while playing football.	**SD**	**D**	**N**	**A**	**SA**
22. It is too costly to provide the safety equipment for my child.	**SD**	**D**	**N**	**A**	**SA**

SD = Strongly Disagree **N** = Neither Agree or Disagree

D = Disagree **A** = Agree **SA** = Strongly Agree

23. Trained coaches are important to reduce the risk of a concussion injury to my child when playing football.	**SD**	**D**	**N**	**A**	**SA**
24. I am confident that I can recognize the signs of a concussion injury.	**SD**	**D**	**N**	**A**	**SA**
25. More awareness in football regarding concussion injuries have positively impacted my decision to involve my child in playing football.	**SD**	**D**	**N**	**A**	**SA**
26. I feel I have received adequate education about concussion injuries.	**SD**	**D**	**N**	**A**	**SA**
27. Information from other parents has **not** influenced my views on my son playing football.	**SD**	**D**	**N**	**A**	**SA**
28. My son has the potential to play football at the **PROFESSIONAL** level.	**SD**	**D**	**N**	**A**	**SA**
29. My son has the potential to receive a **COLLEGE SCHOLARSHIP** for playing football.	**SD**	**D**	**N**	**A**	**SA**
30. My willingness to allow my child to participate in football is influenced by the use of adequate protective equipment.	**SD**	**D**	**N**	**A**	**SA**

SD = Strongly Disagree **N** = Neither Agree or Disagree

D = Disagree **A** = Agree **SA** = Strongly Agree

31. Serious injury is more likely to occur in sports other than football.	**SD**	**D**	**N**	**A**	**SA**
32. If the coaches did not receive concussion education, it would influence my decision regarding my son playing football.	**SD**	**D**	**N**	**A**	**SA**
33. It is important for my son to have fun playing football.	**SD**	**D**	**N**	**A**	**SA**
34. I am confident that I will intervene if the coach doesn't recognize the signs and symptoms of a concussion injury in my son.	**SD**	**D**	**N**	**A**	**SA**
35. I am confident that I know the best treatment for my son if he should sustain a concussion injury.	**SD**	**D**	**N**	**A**	**SA**
36. I do not believe my child is at risk of obtaining a serious concussion injury while playing football.	**SD**	**D**	**N**	**A**	**SA**
37. The risk of a concussion injury is a concern as my son gets older and wants to play football.	**SD**	**D**	**N**	**A**	**SA**

In an effort to understand parents' perspectives, please answer the following questions. Please know there are no "right" or "wrong" answers.

****Feel free to write on the back of the page if you need more room. Be sure to number the question to which you are responding.***

38. What types of **concussion injury education** strategies or programs do you recommend for parents? Please be specific.

_____

_____

_____

_____

_____

_____

39. What **source(s) of concussion injury education** do you trust? (Examples: physicians and other medical providers, researchers, athletic trainers, coaches, league directors, other parents, websites, popular media, etc.) <u>List all education sources you trust.</u>

_____

_____

_____

_____

_____

_____

40. What are the benefits of your son's playing select football that outweighs his risk of experiencing a concussion?

_____

_____

_____

_____

_____

41. What recommendations do you have for effectively preventing and responding to concussion injuries in young select football players?

_____

_____

_____

_____

_____

_____

42. What other comments would you like to add?

_____

_____

_____

_____

_____

_____

Zip Code of Residence: _____

Thank you for your participation!