PARENTAL CONCUSSION EDUCATION ASSESSMENT: A QUALITY IMPROVEMENT INITIATIVE

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Parental Concussion Education Assessment: A Quality Improvement Initiative

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Abstract

Background of Problem

Brain injury is a leading cause of death and disability in children and adolescents. According to the Brain Injury Association of America (2015) ages 0-4 and 15-19 are the two age groups at greatest risk for traumatic brain injury (TBI) or concussion. Five out of ten concussions are not reported or go undetected. The literature indicates there is a lack of parental knowledge on concussion symptoms, treatment, and long-term sequelae. In order to make competent choices for their children related to concussion, parents need to have adequate knowledge.

PICO Question

Will an educational program improve parental knowledge of concussion symptoms, treatment, and long-term sequelae in high-school athletes?

Methodology

This was a pre-test and post-test program evaluation. The sample size was 40 parents of high-school athletes (grades 7-12) in two rural school districts in Northwestern Pennsylvania. The measuring tool was a questionnaire developed by Dr. Craig Coghlin, Dr. Bryan Myles, and Dr. Scott Howitt. Data was obtained during a PowerPoint educational session on concussions.

Statistical Results

There was strong evidence ($t = 2.02$, $p = .00005$) to support the hypothesis that participating in the educational program on concussions will improve your knowledge of concussions.

Conclusions

Parents who attended an educational session on concussion symptoms, treatment, and long-term sequelae had an improvement in knowledge. Future studies should include a larger sample size. Recommendations for mandatory educational sessions for parents of high-school athletes should be considered by each school district.

Keywords: Concussion, Parent, Athlete, Education

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Chapter 1

Introduction

Background of Problem

"Brain injury is a leading cause of death and disability in children and adolescents" (BrainSTEPS, 2015, Brain injury facts section, para. 1). According to the Brain Injury Association of America (2015) ages 0-4 and 15-19 are the two age groups at greatest risk for traumatic brain injury or TBI. Each year children from birth to 19 years sustain an average of 62,000 "brain injuries requiring hospitalization as a result of motor vehicle crashes, falls, sports injuries, physical abuse, and other causes," and "564,000 children are seen in hospital emergency departments for TBI and released" (Brain Injury Association of America, 2015, Incidence section, para. 2). From birth to 14 years, it is estimated that TBI results in "2,685 deaths, 37,000 hospitalizations, and 435,000 emergency department visits" (Brain Injury Association of America, 2015, Incidence section, para. 3). In addition, five out of ten concussions are not reported or go undetected (UPMC Sports Medicine Concussion Program, 2015). The literature indicates that youth athletes often under-report symptoms because they do not understand the seriousness of a concussion and are fearful of being removed from the sport they are taking part in (Bloodgood et al., 2013). Other barriers for reporting symptoms include pressures from coaches, attributing symptoms to another illness, and not wanting to let the team down (Chrisman, Quitiquit, & Rivara, 2012). According to Coghlin, Myles, & Howitt, (2009) it is important to recognize a concussion, even a minor one, because the possibility of experiencing a second one is increased, and the symptoms may be even more severe and take longer to resolve. The literature indicates that there is a lack of parental knowledge in identifying concussion symptoms (Coghlin, Myles, & Howitt, 2009; Gourley, Bay, & McLeod, 2010;

Stevens, Penprase, Kepros, & Dunneback, 2010). In order to make competent choices for their children related to concussions, parents need to have adequate knowledge.

In July of 2012, new legislation was signed into law regarding concussions (Pennsylvania Medical Society, 2013). This law requires that any student with signs of a concussion be removed from play immediately and not return until they are cleared by a trained medical professional. Coaches must now take yearly concussion training courses. Parents and student-athletes are required to sign a form stating they have received and read information sheets on concussion and traumatic brain injury. Schools have the *option* to provide educational sessions for parents, students, trainers, and other medical professionals prior to the start of the sports season. The Pennsylvania Department of Health and the Department of Education are obliged to provide concussion information on their websites. Schools may penalize coaches who do not comply with any of the laws (Pennsylvania Medical Society, 2013).

Problem Statement

There is a lack of parental knowledge on symptoms of concussion, treatment, and long-term sequelae.

Purpose

The aim of this project is to evaluate the effectiveness of an educational program to improve parental knowledge of concussion using a pre-test and post-test design.

PICO Question

Will an educational program improve parental knowledge of concussion symptoms, treatment, and long-term sequelae in high school athletes?

Hypothesis

Parental knowledge of concussion symptoms, recovery, and long-term sequelae, will

increase after participation in an educational program on concussions.

Null hypothesis

There will be no change in parental knowledge after participation in an educational program on concussions.

Definition of Terms

1. Parents- For the purpose of this study, parent or legal guardian of high-school students enrolled in a sport.
2. High-school athletes- For the purpose of this study, all students, male and female, in grades 7-12 enrolled in a sport.
3. Sports- Football, basketball, volleyball, wrestling, baseball/softball, soccer, track or cheerleading.
4. Educational program- PowerPoint presentation on concussion symptoms, treatment, and long-term sequelae.
5. Traumatic Brain Injury- Traumatic brain injury (TBI) is a major cause of death and disability in the United States, contributing to about 30% of all injury deaths. Every day, 138 people in the United States die from injuries that include TBI. Those who survive a TBI can face effects lasting a few days to disabilities which may last the rest of their lives. Effects of TBI can include impaired thinking or memory, movement, and sensation (e.g., personality changes, depression). These issues not only affect individuals but can have lasting effects on families and communities (Centers for Disease Control and Prevention, 2016, para. 1).
6. Symptoms of Concussion- Difficulty thinking clearly, feeling slowed down, difficulty

concentrating, headache, fuzzy or blurry vision, nausea or vomiting (early on), dizziness, sensitivity to noise or light, balance problems, irritability, sadness, more emotional, feelings of euphoria, sleeping more than usual, sleeping less than usual, and trouble falling asleep (Centers for Disease Control and Prevention, 2016).

7. Sequelae- "Condition which is the consequence of a previous disease or injury" (Oxford Dictionaries, 2016, para. 1).

Chapter 2

Review of the Literature

A literature review was conducted using several databases including PubMed, CINAHL, ResearchGate, EBCSO, and Medline. Keywords for the search included concussion, parental knowledge, education in concussion, adult learning, traumatic brain injury, and adolescent concussion. Information from the Center for Disease Control and Prevention was also included. Articles were chosen from January 1, 2010 to present with the exception of 1 article from 2004 discussing Second Impact Syndrome.

Approximately 3.8 million sports and recreation-related concussions occur every year with seventy percent occurring in youth ages 10-19 years (Kurowski, Pomerantz, Schaiper, & Gittelman, 2014). There were 19 out of 258 student athletes at a local school district diagnosed with a concussion in the 2015-2016 school year (Local Athletic Department, 2016). The amount of concussions that were not diagnosed and reported are unknown. A concussion can have lifelong effects and impact future learning in a developing brain (BrainSTEPS, 2015). Effects of a concussion are not always immediately evident, and overtime "difficulties may emerge as the demands are increased on parts of the brain originally injured" (BrainSTEPS, 2015, Brain injury facts section, para. 8).

Concussion is defined as:

> A type of traumatic brain injury-or TBI-caused by a bump, 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, stretching and damaging the brain cells, and creating changes in the brain (Centers for Disease Control and Prevention, 2015, para.1).

First we will review studies examining parental knowledge of concussion. Stevens, Penprase, Kepros, and Dunneback (2010) conducted a study to determine "if parents of children who have a mild TBI are able to identify post-concussive symptoms in their child, which are attributable to their child's injury, after discharge from the emergency department" (p. 178). The participants were a convenience sample of 105 parents of children ages 5 to 17 years who were seen in a pediatric emergency room for a concussion, treated and released. Discharge phone calls were made to parents of children with a discharge diagnosis of concussion or mild TBI. A questionnaire was developed for data collection from the parents based upon two categories for screening pediatric athletes for post-concussive symptoms identified by the Centers for Disease Control (Stevens et al., 2010). This included five signs the parents may see and nine symptoms that a child may experience. The authors concluded that even though parents were given verbal and written discharge instructions, several parents with symptomatic children still reported their child was asymptomatic and not able to identify post-concussive symptoms (Stevens et al., 2010).

In another study Gourley, Bay, and McLeod (2010) looked at the "level of knowledge of youth athletes and their parents regarding concussion and the recognition of its symptoms" (p. 209). The authors also studied whether youth athletes who reported sustaining a hit to the head could identify more concussion signs and symptoms than those who had not, and if parents who had medical training or first aid background were better able to recognize concussion symptoms than parents without first aid or medical training. There was a total of 714 surveys completed including "(357 athletes and 357 parent) and 260 online survey links (130 athlete and 130 parents) to 34 coaches and 27 youth sports organizations..." (Gourley et al., 2010, p. 210). Overall, a major difference was found between parents with first aid or general medical training

and those without. Parents without first aid or general medical training showed a knowledge deficit regarding concussion symptom recognition (Gourley et al., 2010). A concern the study mentioned was that "less than 60% of youth athletes and parents identified sleep disturbances and problems studying and doing class work as additional symptoms of concussion" (Gourley et al., 2010, p. 214). The authors suggest that parents learn the short- and long-term symptoms of concussion.

Bloodgood et al. (2013) studied how athletes and their parents view concussions and their knowledge about concussions. Online surveys were used to gather information on youth ages 13-18 years who are active in sports and parents of children and youth ages 5-18 years old who are active in sports, to look at how these participants view concussions and information related to concussions (Bloodgood et al., 2013). The purpose of this study was to determine the needs and knowledge of concussions for parents and adolescents (Bloodgood et al., 2013). It was found that "more than four out of five youth (84%) and parents (85%) reported that they had heard about concussions" (Bloodgood et al., 2013, p. 36). Awareness was higher with parents of children 10-13 years old and parents who reported using the internet. Viewing concussions as a "critical issue" was higher in youth ages 13-15 as compared to youth ages 16-18 years, and the most identified trusted source for concussion information among parents was the CDC (Bloodgood et al., 2013).

A fourth study conducted by Mannings et al. (2014) assessed "parental knowledge regarding the definition, symptoms, and signs of concussion in young athletes (5-15 years) participating in recreational tackle football" (p. S19). The authors used an "anonymous survey of a convenience sample of parents of children aged 5 years to 15 years enrolled in a nationally recognized football league" (Mannings et al, 2014, p. S19). Out of 369 parents, 310 completed the

questionnaire. The study revealed that 94% of the parents stated their child never had a concussion, but only 13% could correctly identify all the symptoms related to a concussion (Mannings et al, 2014). There were no parents that were able to correctly identify all symptoms related to a concussion. Another notable finding was "two thirds of the parents failed to recognize that a concussion is considered a mild TBI" (Mannings et al., 2014, p. s21).

Lin et al. (2015) assessed parental knowledge and attitude towards sports-related concussions. This study "sought to characterize the parent populations most deficient in concussion knowledge" (Lin et al., 2015, p. 125). Using a previously validated assessment tool, the authors used a cross-sectional survey design and "tested participants' knowledge of concussion signs and symptoms, treatment, and return-to-play guidelines, as well as their attitudes regarding medical diagnosis, follow-up, and post-concussion sports participation…" (Lin et al., 2015, p. 125). There were 214 surveys completed. "Participants scored an average of 18.4 (possible, 0-25) on the Concussion Knowledge Index and 63.1 (possible, 15-75) on the Concussion Attitude Index" (Lin et al., 2015, p. 124). Overall, the authors concluded that "results suggest that parents with low incomes and education levels may benefit from additional concussion-related education" (Lin et al., 2015, p. 128).

The last study examined parental knowledge of concussion symptoms and was conducted by Coghlin, Myles, & Howitt (2009). The authors assessed "the ability of hockey parents/guardians to recognize concussion symptoms in their 13-14 year old children" (Coghlin et al., 2009, p. 233). The authors developed a questionnaire that specifically focused on parent's knowledge of concussions, signs, and symptoms. It was found that mothers scored higher than fathers in identifying signs and symptoms of concussion, but symptoms such as difficulty with sleep, disorientation symptoms, and emotional irritability, were not recognized and should be

better known (Coghlin et al., 2009).

Parents are in the best position to recognize concussion symptoms because of access to their child. The importance of parents knowing how to recognize concussion symptoms is critical because literature demonstrates athletes do not report possible concussions or concussions go undiagnosed as evidenced in these next few studies.

Register-Mihalik et al. (2013) looked at athletes who reported participation in sports while experiencing symptoms from a possible concussion, and the self-reported percentage of recalled concussion events. The authors used a cross-sectional survey study of high-school athlete's ages 14-18 years in six sports. The sample was a convenience sample of twenty high schools in nine states. The instrument used was a survey of "35 questions concerning concussion symptom recognition, complications related to multiple concussions, and general knowledge of concussions" (Register-Mihalik et al., 2013, p.648). Overall, it was found that "most of the concussions recalled by high-school athletes were not reported and that concussion knowledge and attitudes both play a role in concussion-reporting behaviors" (Register-Mihalik et al., 2013, p. 650).

A study by Meehan et al. (2013) was conducted as a multi-centered, cross sectional design "to determine whether athletes in their clinics had sustained previous concussions that went undiagnosed" (p. 339). Out of 731 patients, 486 patients were included in the final study. The authors found that 148 patients (30.5%) reported a blow to the head and one or more of the signs and symptoms on the Post-Concussion Symptom Scale but were not diagnosed with a concussion (Meehan et al., 2013). "Athletes reporting previously undiagnosed concussions had a higher mean Post Concussion Symptoms Scale score (33 v. 25: p, 0.004) and were more likely to have lost consciousness (31% v. 22%; p=0.038) with their current injury than athletes without

previously undiagnosed concussions" (Meehan et al., 2013, p. 340).

Research by Stevens, Penprase, Kepros, & Dunneback (2010) shows that parents were unable to identify post-concussive symptoms in their child three to five days after being diagnosed in the emergency room. The parents were given written and verbal instructions in the emergency room, but when a follow up phone call was done three to five days later they reported their child to be asymptomatic. However, when they were asked about specific symptoms seen with concussions, they reported that the child was having some of those symptoms. The parents did not recognize or did not attribute the symptom to the child's recent concussion (Stevens, Penprase, Kepros, & Dunneback, 2010).

Several studies discussing concussion signs, symptoms, treatment, and recovery were reviewed.

> Concussion symptoms can vary and be vague which can make them difficult to recognize. These symptoms can be broken up into four categories. 1) Physical symptoms including headache, dizziness, drowsiness, nausea, vomiting, numbness/tingling, balance issues, and phonophobia/photophobia. 2) Cognitive symptoms including mentally foggy, feeling slowed down, difficulty concentrating, difficulty remembering, forgetful of recent info or conversations, confused about recent events, answering questions slowly, and repeating questions. 3) Emotional symptoms including irritability, sadness, more emotional, and nervousness. 4) Sleep symptoms including drowsiness, sleeping less than usual, sleeping more than usual, and trouble falling asleep (Center for Disease Control and Prevention, 2015).

The symptoms may not be evident for hours or even days from the time of the injury (Jamault, 2013).

Concussions are a cognitive injury. Unless there is skull fracture or hemorrhage, imaging will not be helpful in diagnosis (Jamault, 2013). Diagnosis is based on a detailed history of injury, cognitive abilities, behaviors, balance ability, sleep patterns, physical symptoms, and neurological testing (Jamault, 2013). Computerized neurocognitive testing (ImPACT) is a reliable test for post-concussion serial assessments in college-age athletes but should not be used as a stand-alone measure (Nakayama, Covassin, Schatz, & Kovan, 2014). There is very little data available on the reliability of ImPACT testing in adolescents. ImPACT testing should be done prior to the start of sports season as a baseline. If the athlete sustains an injury or a concussion is suspected, then post-injury ImPACT testing should be done. Again, this tool is useful when combined with a thorough history, exam, and other neurological and balance testing but should not be used as a single diagnostic tool (Nakayama et al., 2014).

Cognitive and physical rest is the cornerstone of concussion management and recovery (Halstead & Walter, 2010). Each patient with a concussion is different. Some may take longer to recover than others. A more conservative approach should be taken with children and adolescents with a concussion, including a longer asymptomatic period before return to play (Scorza, Raleigh, & O'Connor, 2012). The initial management of a concussion should include cognitive rest which consists of no electronic devices (cell phone, iPod, video games, computers, headphones and TV), limited schoolwork, and restrict any activity that requires attention or concentration (Scorza et al., 2012). A dark and quiet environment with bedrest may be needed the first few days. Physical rest is also part of the initial management. There should not be any exercising, sports, weight lifting or strenuous activity (Scorza et al., 2012). Schools should be notified of a concussion and academic accommodations need to be made. The student should be permitted to have more time to complete assignments, avoid standardized testing, frequent rest

periods during the school day, and test scores should be monitored for scholastic difficulties (Scorza et al., 2012). Medication can be used to treat symptoms. Tylenol is recommended for headaches. Sleep aids may be needed if there is sleep difficulty. In some cases, an SSRI may be needed if there is persistent depression following a concussion (Scorza et al., 2012). A graded return to play protocol should be followed. Once the athlete is symptom free, then they may begin to return to normal activity slowly. Introduce one activity at a time and give twenty four hours to make sure that the activity does not cause a return of concussion symptoms. Once they return to play and full daily activity, they should be monitored closely for the return of symptoms (Scorza et al., 2012).

Long-term sequelae of concussions can include Post-Concussive Syndrome or Second-Impact Syndrome. Post-Concussive Syndrome is somatic, emotional, and cognitive symptoms that last up to six months after a concussion (Cobb & Battin, 2004). Second-Impact Syndrome (SIS) occurs when one receives a second head injury before the brain has time to recover from the first one. High-school athletes are in more danger of SIS due to their age, type of sport, and prior history of concussion (Cobb & Battin, 2004). High-school athletes will have a longer recovery time than college-age athletes who have sustained a concussion. Those athletes who have a history of more than one concussion are also at higher risk (Cobb & Battin, 2004). SIS is severe, and it involves rapid brain swelling and herniation. It does not have to be from a direct blow to the head but could be caused by a blow to the body that causes an indirect acceleration of the brain (Cobb & Battin, 2004). Those athletes with SIS may appear stunned but will initially remain conscience. Then they will quickly decline and collapse with rapidly dilating pupils, fixed eye movements, and will have respiratory and brainstem failure (Cobb & Battin, 2004).

Recognition of concussion symptoms and education are imperative for the high-school athlete, parents, trainers, and coaches. "A clear understanding of the definition, signs, and symptoms of concussion is necessary to recognize and rule out a more severe intracranial injury" (Halstead & Walter, 2010, p. 597).

There are various studies highlighting the importance of parental knowledge of concussion signs, symptoms, treatment, and recovery. Many of these studies used surveys or questionnaires to determine knowledge of concussion. By presenting an educational program on concussions to parents and utilizing a pre-test and post-test design, it is hoped that parental knowledge of concussions will increase thereby showing the effectiveness of concussion education.

Adult Learning Theory

Malcolm Knowles Adult Learning Theory or also called andragogy, was used to guide this projects' educational program on concussions, specifically focusing on the experience and motivation of the parents being addressed. The foundation of Knowles Adult Learning Theory was based on four assumptions about the characteristics of adult learners that differ from child learners, or pedagogy (Smith, 1996; 1999; 2010). A fifth assumption was added later.

- Self-concept: As a person matures, his self- concept moves from one of being a dependent personality toward one of being a self-directed human being.
- Experience: As a person matures, he accumulates a growing reservoir of experience that becomes an increasing resource for learning.
- Readiness to learn: As a person matures, his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles.

- Orientation to learning: As a person matures, his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem centeredness (Smith, 1996; 1999; 2010, para. 2).

- Motivation to learn: As a person matures, the motivation to learn is internal (Knowles 1984:12 as cited in Smith, 1996; 1999; 2010, para.2).

When looking specifically at experience and motivation to learn as it pertains to this project, a parent of an athlete may have already endured caring for a child with a concussion or have themselves experienced a concussion. Past learning experiences about concussions may facilitate in making this learning experience more meaningful or help the parent "connect the current learning experience to something learned in the past" (Russell, 2006, p.350). A parent of an athlete knows there are certain risks of injury associated with sports and therefore may be more motivated to learn about concussion symptoms, treatment, and long-term sequelae.

When looking at adult learners, most "enter into a learning experience to create change," (Olff, 2012, para. 2). "In health care, this can mean a change in skills, behavior, knowledge-level, or attitudes and beliefs" (Olff, 2012, para.2). As Malcolm Knowles characteristics of adult learners are considered, it is also important to contemplate adult learning styles. There are three common learning styles based on the senses that adult learners may have developed a preference for in childhood (Olff, 2012). These learning styles are visual, auditory and kinesthetic. Visual learners "prefer seeing what they are learning." "They appreciate pictures, images and diagrams to help them process ideas." "Visuals help the learner create a mental image that helps them hold onto the information" (Olff, 2012, para.4). Auditory learners prefer to hear to learn. They remember what others say and remember best through verbal repetition and by saying things out

loud. They remember verbal instruction well and enjoy group discussions. Written information can be reinforced with verbal instruction (Olff, 2012; Russell, 2006). Kinesthetic learners want to feel or sense whatever is being learned. They enjoy hands-on activities and can remember how to do things after doing them once. They will take notes but do not often use them. They enjoy computers and have trouble staying in one place for extended periods of time (Olff, 2012; Russell, 2006).

In order to try and touch upon each learning style, various methods to the educational program will be used. The program will consist of a PowerPoint presentation for the visual learner with auditory teaching with each slide. Questions and discussion will be encouraged. A pre- and post-test for hands-on learning and a handout of the PowerPoint on which to take notes will be included. Multimedia will be integrated within the PowerPoint, and the presentation will be kept to 30 minutes so the audience will not be seated for an extended period of time.

The learning environment is also important when trying to enhance the learner's ability to focus. Olff (2012) suggests following theses five elements via the acronym SPECH when preparing to offer adult education. S stands for the social environment. "Adults are social and need to belong within a social setting. When teaching in group settings include opportunities to socialize, breaks, name tags, introductory activities" (Olff, 2012, para.5). P standing for the physical environment, tells us that adults need to be comfortable to learn. Consider elements such as room size, noise and light. E stands for the emotional environment meaning to maintain respect, trust, and the adult's self-esteem (Olff, 2012). C stands for the cognitive environment. "Adult learners need to feel what they are learning will be relevant and beneficial to them. Some ways to address this include: encouraging their involvement, make it clear what's in it for them, and acknowledge their prior experiences" (Olff, 2012, para.5). The last letter H stands for the

holistic environment. Adults have varying needs and differences when learning. It is beneficial to recognize cultural and personal differences and beliefs and use a variety of examples to meet multiple needs (Olff, 2012).

Malcolm Knowles Adult Learning Theory is an appropriate framework to guide this project's educational concussion program to parents of high-school athletes. This select group of parents brings with them experience in what they have learned in the past about concussions as well as the motivation to learn about concussions. Various methods of instruction will be used in order to reach each of the three learning styles. The five elements of a successful learning environment will be followed to enhance the parent's ability to focus on the content being presented.

Chapter 3

Methodology

This was a pre-test and post-test program evaluation with a sample consisting of 40 parents of athletes in grades 7-12 enrolled in football, basketball, volleyball, baseball/softball, soccer, track, wrestling, or cheerleading in two rural school districts of Northwestern Pennsylvania. The measuring instrument for this inquiry was a questionnaire that was developed by Dr. Craig Coghlin, BA, CSCS, DC, Dr. Bryan Myles, BSc, DC, and Dr. Scott Howitt BA, CK, CSCS, DC, FCCSS (C), FCCRS (see Appendix A for questionnaire). Permission to use and modify the questionnaire was obtained by Dr. Scott Howitt BA, CK, CSCS, DC, FCCSS (C), FCCRS (see Appendix B for permission). Data from the tests was calculated as central tendency measures and percentages. Data collection occurred during the months of August, 2016 through November, 2016.

Research Design

This was a pre-test and post-test program evaluation. The pre-test and post-test design will evaluate the effectiveness of the educational program (independent variable) on parental knowledge (dependent variable) of concussion symptoms, treatment, and long-term sequelae.

PICO Question

Will an educational program improve parental knowledge of concussion symptoms, treatment, and long-term sequelae in high-school athletes?

Hypothesis

Parental knowledge of concussion symptoms, treatment, and long-term sequelae will increase after participation in an educational program on concussions.

Null Hypothesis

There will be no change in parental knowledge after participation in an educational program on concussions.

Sample

The sample for this study consisted of 40 parents of high-school athletes in grades 7-12 enrolled in football, basketball, soccer, volleyball, baseball/softball, track, wrestling, or cheerleading in two rural school districts in Northwestern Pennsylvania. Permission to conduct the study was obtained from the superintendents of the rural school districts where the study has taken place (see Appendices C and D for permission letters).

Instrumentation

The measuring instrument for this study was a questionnaire that was developed by Dr. Craig Coghlin, BA, CSCS, DC, Dr. Bryan Myles, BSc, DC, and Dr. Scott Howitt BA, CK, CSCS, DC, FCCSS(C), FCCRS. The questionnaire was originally adapted from the Sports Concussion Assessment Tool (SCAT) (see Appendix E for the SCAT tool) that was evaluated for face and content validity on the basis of scientific literature and the clinical experience of the authors listed (Coghlin, Myles, & Howitt, 2009). Permission to use and modify the questionnaire was obtained by Dr. Scott Howitt BA, CK, CSCS, DC, FCCSS(C), FCCRS. There were minimal modifications in the demographics and four questions were added.

Data Collection

Data collection occurred when parents came in for the recommended educational program on concussions. Information was sent out to coaches, trainers, school nurses, and the athletic director prior to the program to inform parents of time, place, and location of the study.

Information was also communicated by word of mouth and the school-based web site. The times were correlated to practice schedules, sports physicals, booster meetings, and IMPACT testing to make it more convenient to parents. Consent to participate was obtained (see Appendix F for consent form). Data has been kept confidential. The questionnaires were numbered to compare pre- and post-test results. There was not any information to identify participants. Parents received the questionnaire (pre-test) to fill out as they came in for the program. The pre-test was collected prior to viewing the program. The program was then implemented by a PowerPoint presentation (see Appendix G for PowerPoint presentation). Upon completion of the program the second questionnaire was distributed for the post-test. All data was collected prior to the parents leaving the program.

Treatment of Data

The level of measurement was nominal and ordinal. Data from the tests was calculated as measures of central tendency and percentages.

Summary

This DNP Project was a pre-test and post-test program evaluation. The purpose was to investigate, via pre-test and post-test, parental knowledge of concussion symptoms, treatment, and long-term sequelae in two school districts in rural Northwestern Pennsylvania. The sample for this study consisted of 40 parents of high-school athletes in grades 7-12 enrolled in a sport in two rural school districts in Northwestern Pennsylvania. Permission to conduct the study was obtained from the superintendents of the school districts where the study had taken place. The measuring instrument for this study was a questionnaire that was developed by Dr. Craig Coghlin, BA, CSCS, DC, Dr. Bryan Myles, BSc, DC, and Dr. Scott Howitt, BA, CK, CSCS, DC,

FCCSS (C), FCCRS. The levels of measurement were at the nominal and ordinal level. Data collection occurred when parents came in for the recommended educational program on concussions during the months of August through November of 2016. Consent to participate was obtained and all data was kept confidential.

There were no grants obtained for this study. The costs were minimal.

Chapter 4

Results and Discussion

The purpose of this study was to evaluate the effectiveness of an educational program to improve knowledge of concussions using a pre-test and post-test design with a sample consisting of 40 parents of athletes in grades 7-12 enrolled in football, basketball, volleyball, baseball/softball, soccer, track, wrestling, or cheerleading in two rural school districts in Northwestern Pennsylvania. There were 40 parents who participated in the educational program and all 40 pre-tests and post-tests were returned for a 100% response rate.

Results

This was a pre-test and post-test program evaluation. Data collection was planned for two educational sessions that were advertised to parents via pamphlets, coaches, athletic director, word of mouth, and a school-based web site. The turnout for these sessions was lower than anticipated so the investigators took the program to the parents by attending various booster meetings in order to make it more convenient for them. Data collection occurred from August, 2016 through November, 2016. Consent was signed by all participants prior to the study. (N=40) The questionnaires were numbered in order to compare the pre- and post-tests. They were numbered 1-41. It is noted that number 39 was skipped accidentally when the questionnaires were being distributed. The pre-test was administered at the beginning of the session. Upon completion of the pre-test, an educational PowerPoint presentation was provided for the parents. The post-test was then completed. All tests were collected at the time of the educational session. The session took approximately 30 to 45 minutes to complete. Everyone at the educational sessions and booster meetings participated and completed the pre- and post-tests for a 100 % response rate.

Data analysis using a paired t-test demonstrated that a mean of 27.55 questions were answered correctly in the pre-test and a mean of 29.35 questions were answered correctly on the post-test (Fig 1). This was a mean difference of 1.8 questions.

Figure 1

Participant	PRE-SCORE	POST-SCORE	Difference
1	24	31	7
2	29	29	0
3	30	29	-1
4	28	26	-2
5	26	29	3
6	27	31	4
7	26	28	2
8	28	28	0
9	27	29	2
10	28	30	2
11	28	29	1
12	27	27	0
13	30	28	-2
14	31	28	-3
15	28	29	1
16	26	29	3
17	30	29	-1
18	29	30	1
19	28	29	1
20	23	29	6
21	27	28	1
22	27	31	4
23	23	28	5
24	26	32	6
25	27	31	4
26	31	31	0
27	28	32	4
28	23	30	7
29	28	29	1
30	26	31	5
31	30	31	1

32	29	29	0
33	27	26	-1
34	29	29	0
35	30	30	0
36	28	29	1
37	30	31	1
38	27	30	3
40	28	30	2
41	25	29	4
	Sample Mean	28.45	1.8
	Std. Dev	1.980	2.493

The results indicated that there was a 67.5 % improvement rate (27 participants), 15.0% declined (6 participants), and 17.5 % (7 participants) remained unchanged (Fig 2).

Figure 2

Participant Summary **(POST-PRE)/PRE**

Participant	Perfect Score	PRE-SCORE	PRE-%	POST-SCORE	POST-%	Improvement in Score
1	32	24	**75.0%**	31	**96.9%**	**29.2%**
2	32	29	**90.6%**	29	**90.6%**	**0.0%**
3	32	30	**93.8%**	29	**90.6%**	**-3.3%**
4	32	28	**87.5%**	26	**81.3%**	**-7.1%**
5	32	26	**81.3%**	29	**90.6%**	**11.5%**
6	32	27	**84.4%**	31	**96.9%**	**14.8%**
7	32	26	**81.3%**	28	**87.5%**	**7.7%**
8	32	28	**87.5%**	28	**87.5%**	**0.0%**
9	32	27	**84.4%**	29	**90.6%**	**7.4%**
10	32	28	**87.5%**	30	**93.8%**	**7.1%**
11	32	28	**87.5%**	29	**90.6%**	**3.6%**
12	32	27	**84.4%**	27	**84.4%**	**0.0%**
13	32	30	**93.8%**	28	**87.5%**	**-6.7%**
14	32	31	**96.9%**	28	**87.5%**	**-9.7%**
15	32	28	**87.5%**	29	**90.6%**	**3.6%**

16	32	26	**81.3%**	29	**90.6%**	**11.5%**
17	32	30	**93.8%**	29	**90.6%**	**-3.3%**
18	32	29	**90.6%**	30	**93.8%**	**3.4%**
19	32	28	**87.5%**	29	**90.6%**	**3.6%**
20	32	23	**71.9%**	29	**90.6%**	**26.1%**
21	32	27	**84.4%**	28	**87.5%**	**3.7%**
22	32	27	**84.4%**	31	**96.9%**	**14.8%**
23	32	23	**71.9%**	28	**87.5%**	**21.7%**
24	32	26	**81.3%**	32	**100.0%**	**23.1%**
25	32	27	**84.4%**	31	**96.9%**	**14.8%**
26	32	31	**96.9%**	31	**96.9%**	**0.0%**
27	32	28	**87.5%**	32	**100.0%**	**14.3%**
28	32	23	**71.9%**	30	**93.8%**	**30.4%**
29	32	28	**87.5%**	29	**90.6%**	**3.6%**
30	32	26	**81.3%**	31	**96.9%**	**19.2%**
31	32	30	**93.8%**	31	**96.9%**	**3.3%**
32	32	29	**90.6%**	29	**90.6%**	**0.0%**
33	32	27	**84.4%**	26	**81.3%**	**-3.7%**
34	32	29	**90.6%**	29	**90.6%**	**0.0%**
35	32	30	**93.8%**	30	**93.8%**	**0.0%**
36	32	28	**87.5%**	29	**90.6%**	**3.6%**
37	32	30	**93.8%**	31	**96.9%**	**3.3%**
38	32	27	**84.4%**	30	**93.8%**	**11.1%**
40	32	28	**87.5%**	30	**93.8%**	**7.1%**
41	32	25	**78.1%**	29	**90.6%**	**16.0%**

Participants	**%**	**PRE vs POST**
27	**67.5%**	**Improved**
6	**15.0%**	**Declined**
7	**17.5%**	**Stayed the same**

The questions were broken down and scored individually on the pre- and post-test questionnaires for comparison (Fig 3). 62.5% (20 questions) improved, 12.5% (4 questions) declined, and 25.0% (8 questions) remained the same.

Figure 3

Question Summary

			PRE-Test		POST-Test		% that got the correct Answer		Answer improvement on POST-Test
#	Question	Answers	Correct	Wrong	Correct	Wrong	PRE-Test	POST-Test	(POST-PRE)/PRE
1YN	Loss of consciousness	N	37	3	39	1	92.5%	97.5%	5.4%
2YN	Return to play same day	N	40	0	39	1	100.0%	97.5%	-2.5%
3YN	Blow to neck, jaw, or elsewhere	Y	34	6	38	2	85.0%	95.0%	11.8%
4YN	Evaluated	Y	37	3	40	0	92.5%	100.0%	8.1%
5YN	CT scan required	N	35	5	40	0	87.5%	100.0%	14.3%
6YN	Coaches receive concussion training	Y	32	8	39	1	80.0%	97.5%	21.9%
7YN	Examined by Provider	Y	33	7	39	1	82.5%	97.5%	18.2%
8YN	Brain Damage	Y	39	1	40	0	97.5%	100.0%	2.6%
9YN	Recovery Time	Y	40	0	40	0	100.0%	100.0%	0.0%
1TF	Headache	T	40	0	40	0	100.0%	100.0%	0.0%
2TF	Neck pain	T	34	6	39	1	85.0%	97.5%	14.7%
3TF	Difficulty w/ urination	F	33	7	37	3	82.5%	92.5%	12.1%
4TF	Dizziness	T	40	0	40	0	100.0%	100.0%	0.0%
5TF	Lowered pulse rate	F	22	18	27	13	55.0%	67.5%	22.7%
6TF	Ringing in Ears	T	39	1	39	1	97.5%	97.5%	0.0%
7TF	Difficulty falling asleep	T	31	9	40	0	77.5%	100.0%	29.0%
8TF	Slurred speech	T	35	5	37	3	87.5%	92.5%	5.7%
9TF	Difficulty concentrating	T	40	0	40	0	100.0%	100.0%	0.0%
10TF	Drowsiness/fatigue	T	37	3	40	0	92.5%	100.0%	8.1%
11TF	Hear voices	T	16	24	16	24	40.0%	40.0%	0.0%
12TF	Sinus congestion	F	26	14	32	8	65.0%	80.0%	23.1%
13TF	Inability to describe time/place	T	40	0	40	0	100.0%	100.0%	0.0%
14TF	Seizures	T	35	5	28	12	87.5%	70.0%	-20.0%
15TF	Euphoria	T	19	21	24	16	47.5%	60.0%	26.3%
16TF	Inability to swallow	F	26	14	31	9	65.0%	77.5%	19.2%
17TF	Chest pain	F	31	9	35	5	77.5%	87.5%	12.9%
18TF	Pressure in head	T	38	2	38	2	95.0%	95.0%	0.0%
19TF	Difficulty with memory	T	39	1	40	0	97.5%	100.0%	2.6%
20TF	Nauseous	T	39	1	38	2	97.5%	95.0%	-2.6%
21TF	Problems with vision	T	40	0	39	1	100.0%	97.5%	-2.5%
22TF	Increased emotion/irritability	T	37	3	40	0	92.5%	100.0%	8.1%
23TF	Increased sleeping	T	38	2	40	0	95.0%	100.0%	5.3%

Questions	%	PRE vs POST
20	**62.5%**	**Improved**
4	**12.5%**	**Declined**
8	**25.0%**	**Stayed the same**

Parents who had a child with previous history of concussion were compared to those with no history of concussion (Fig 4). Those who had a child with a history of concussion had a mean difference of 1.83 in pre- and post-test answers and those with no history of concussion had a mean difference of 1.79 (Fig 5&6). This was a mean difference of 0.04.

Figure 4

Previous Concussion - Y

Participant	Past Concussion(s)	PRE-SCORE	POST-SCORE	Difference
1	Y	24	31	7
2	Y	29	29	0
8	Y	28	28	0
10	Y	28	30	2
17	Y	30	29	-1
24	Y	26	32	6
25	Y	27	31	4
26	Y	31	31	0
29	Y	28	29	1
33	Y	27	26	-1
37	Y	30	31	1
38	Y	27	30	3

Previous Concussion - N

Participant	Past Concussion(s)	PRE-SCORE	POST-SCORE	Difference
3	N	30	29	-1
4	N	28	26	-2
5	N	26	29	3
6	N	27	31	4

7	N	26	28	2
9	N	27	29	2
11	N	28	29	1
12	N	27	27	0
13	N	30	28	-2
14	N	31	28	-3
15	N	28	29	1
16	N	26	29	3
18	N	29	30	1
19	N	28	29	1
20	N	23	29	6
21	N	27	28	1
22	N	27	31	4
23	N	23	28	5
27	N	28	32	4
28	N	23	30	7
30	N	26	31	5
31	N	30	31	1
32	N	29	29	0
34	N	29	29	0
35	N	30	30	0
36	N	28	29	1
40	N	28	30	2
41	N	25	29	4

Figure 5

t-Test: Paired Two Sample for Means

Past Concussion(s)	*PRE-SCORE*	*POST-SCORE*
Mean	27.92	29.75
Variance	3.720	2.750
Observations	12	12
Pearson Correlation	-0.092378424	
Hypothesized Mean Difference	0	
df	11	
t Stat	-2.390072457	
P(T<=t) one-tail	0.017928398	
t Critical one-tail	1.795884819	
P(T<=t) two-tail	0.035856797	
t Critical two-tail	2.20098516	

Figure 6

t-Test: Paired Two Sample for Means

No Past Concussion(s)	*PRE-SCORE*	*POST-SCORE*
Mean	27.39	29.18
Variance	4.544	1.708
Observations	28	28
Pearson Correlation	0.027067514	
Hypothesized Mean Difference	0	
df	27	
t Stat	-3.825667637	
P(T<=t) one-tail	0.000350317	
t Critical one-tail	1.703288446	
P(T<=t) two-tail	0.000700634	
t Critical two-tail	2.051830516	

The data was analyzed further by comparing the knowledge of fathers verses mothers (Fig 7). The fathers began with a mean pre-test score of 26.09 and finished with a mean post-test score of 29.09. This was a mean difference of 3 questions (Fig 8). The mothers began with a mean pre-test score of 28.10 and finished with a mean post-test score of 29.45. This was a mean difference of 1.34 questions (Fig 9).

Figure 7

Participant	Mother or Father	PRE-SCORE	POST-SCORE	Difference
1	M	24	31	7
2	M	29	29	0
3	M	30	29	-1
4	F	28	26	-2
5	F	26	29	3
6	M	27	31	4
7	M	26	28	2
8	F	28	28	0
9	M	27	29	2

10	M	28	30	2
11	M	28	29	1
12	M	27	27	0
13	M	30	28	-2
14	M	31	28	-3
15	M	28	29	1
16	M	26	29	3
17	M	30	29	-1
18	M	29	30	1
19	M	28	29	1
20	F	23	29	6
21	F	27	28	1
22	M	27	31	4
23	F	23	28	5
24	M	26	32	6
25	M	27	31	4
26	M	31	31	0
27	F	28	32	4
28	F	23	30	7
29	M	28	29	1
30	F	26	31	5
31	M	30	31	1
32	M	29	29	0
33	M	27	26	-1
34	M	29	29	0
35	F	30	30	0
36	M	28	29	1
37	M	30	31	1
38	M	27	30	3
40	M	28	30	2
41	F	25	29	4

Figure 8

t-Test: Paired Two Sample for Means

Fathers	*PRE-SCORE*	*POST-SCORE*
Mean	26.09	29.09
Variance	5.691	2.691
Observations	11	11
Pearson Correlation	0.02323095	
Hypothesized Mean Difference	0	
df	10	
t Stat	-3.47464685	
P(T<=t) one-tail	0.002987232	
t Critical one-tail	1.812461123	
P(T<=t) two-tail	0.005974465	
t Critical two-tail	2.228138852	

Figure 9

t-Test: Paired Two Sample for Means

Mothers	*PRE-SCORE*	*POST-SCORE*
Mean	28.10	29.45
Variance	2.739	1.828
Observations	29	29
Pearson Correlation	-0.085319314	
Hypothesized Mean Difference	0	
df	28	
t Stat	-3.255657097	
P(T<=t) one-tail	0.001478299	
t Critical one-tail	1.701130934	
P(T<=t) two-tail	0.002956598	
t Critical two-tail	2.048407142	

Final analysis breakdown included the comparison of which sports each subjects school-age athlete participated in and whether the sport had an association with the mean improvement score

from the pre-test to post-test questionnaires. Those who had an athlete who participated in basketball (24) had a mean pre-test score of 27.58 and a mean post-test score of 29.63 with a mean difference of 2.04 (Fig 10). Participants' in football (17) had a mean pre-test score of 27.65 and a mean post-test score of 30.00 with a mean difference of 2.35 (Fig 11). Participants' in track (15) had a mean pre-test score of 27.33 and a mean post-test score of 29.60 with a mean difference of 2.27 (Fig 12). Participants' in volleyball (22) had a mean pre-test score of 27.41 and mean post-test score of 28.68 with a mean difference of 1.27 (Fig 13). Participants' in soccer (9) had a mean pre-test score of 27.67 and a mean post-test score of 29.00 with a mean difference of 1.33 (Fig 14). Participants' in softball/baseball (14) had a mean pre-test score of 28.0 and a mean post-test score of 29.07 with a mean difference of 1.07 (Fig 15). Finally, participants' in wrestling (3) had a mean pre-test score of 26.67 and mean post-test score of 30.33 with a mean difference of 3.66 (Fig 16). Cheerleading had been part of the original inclusion criteria, however, it was noted that there were not any parents of cheerleaders in any of the educational sessions.

Figure 10

t-Test: Paired Two Sample for Means

Basketball - Y	*PRE-SCORE*	*POST-SCORE*
Mean	27.58	29.63
Variance	5.036	1.723
Observations	24	24
Pearson Correlation	-0.08487239	
Hypothesized Mean Difference	0	
df	23	
t Stat	-3.712362071	
P(T<=t) one-tail	0.000572949	
t Critical one-tail	1.713871528	
P(T<=t) two-tail	0.001145899	
t Critical two-tail	2.06865761	

Figure 11

t-Test: Paired Two Sample for Means

Football - Y	*PRE-SCORE*	*POST-SCORE*
Mean	27.65	30.00
Variance	3.493	2.000
Observations	17	17
Pearson Correlation	0	
Hypothesized Mean Difference	0	
df	16	
t Stat	-4.13946947	
P(T<=t) one-tail	0.000385067	
t Critical one-tail	1.745883676	
P(T<=t) two-tail	0.000770134	
t Critical two-tail	2.119905299	

Figure 12

t-Test: Paired Two Sample for Means

Track - Y	*PRE-SCORE*	*POST-SCORE*
Mean	27.33	29.60
Variance	4.667	1.400
Observations	15	15
Pearson Correlation	-0.139725142	
Hypothesized Mean Difference	0	
df	14	
t Stat	-3.371226563	
P(T<=t) one-tail	0.002283482	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.004566965	
t Critical two-tail	2.144786688	

Figure 13

t-Test: Paired Two Sample for Means

Volleyball - Y	*PRE-SCORE*	*POST-SCORE*
Mean	27.41	28.68
Variance	4.825	1.465
Observations	22	22
Pearson Correlation	-0.091987555	
Hypothesized Mean Difference	0	
df	21	
t Stat	-2.292750527	
P(T<=t) one-tail	0.016144244	
t Critical one-tail	1.720742903	
P(T<=t) two-tail	0.032288488	
t Critical two-tail	2.079613845	

Figure 14

t-Test: Paired Two Sample for Means

Soccer - Y	*PRE-SCORE*	*POST-SCORE*
Mean	27.67	29.00
Variance	5.000	1.250
Observations	9	9
Pearson Correlation	0.4	
Hypothesized Mean Difference	0	
df	8	
t Stat	-1.940285	
P(T<=t) one-tail	0.044153714	
t Critical one-tail	1.859548038	
P(T<=t) two-tail	0.088307428	
t Critical two-tail	2.306004135	

Figure 15

t-Test: Paired Two Sample for Means

Softball/Baseball - Y	*PRE-SCORE*	*POST-SCORE*
Mean	28.00	29.07
Variance	2.308	2.225
Observations	14	14
Pearson Correlation	0.373395057	
Hypothesized Mean Difference	0	
df	13	
t Stat	-2.378579457	
P(T<=t) one-tail	0.016698226	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	0.033396453	
t Critical two-tail	2.160368656	

Figure 16

t-Test: Paired Two Sample for Means

Wrestling - Y	*PRE-SCORE*	*POST-SCORE*
Mean	26.67	30.33
Variance	1.333	4.333
Observations	3	3
Pearson Correlation	0.693375245	
Hypothesized Mean Difference	0	
df	2	
t Stat	-4.157609203	
P(T<=t) one-tail	0.026635369	
t Critical one-tail	2.91998558	
P(T<=t) two-tail	0.053270738	
t Critical two-tail	4.30265273	

Discussion

This study examined the effectiveness of an educational program designed to improve parental knowledge of concussion symptoms, treatment, and long-term sequelae. Parents of high-school athletes in 7-12th grade who participated in basketball, football, track, soccer, wrestling, baseball/softball, volleyball, or cheerleading in two rural Northwestern Pennsylvania school districts were included in this study. There were 40 participants who completed the educational program. The parents who participated in the study had a variety of occupations with differences in their experience in dealing with a previous concussion in their athlete. One participant did not list an occupation (Fig 17).

There was strong evidence ($t = 2.02$, $p = .00005$) to support the hypothesis that participating in the educational program on concussions will improve a parent's knowledge of concussion symptoms, treatment, and long-term sequelae. In this data set, the participants had a mean score of 27.55 and a standard deviation of 2.06 on their pre-test and then after participating in the educational program their mean score increased 1.8 points reflected in their post-test that has a mean score of 29.35 and a standard deviation of 1.42. The T-value obtained from the analysis of the overall mean scores of the pre-test and the post-test was 2.02. The mean of the paired difference was 1.80 with standard deviation 2.49. The data also revealed that the P-value, or value of significance is 0.00005, at the level of 0.05. The analysis shows that there was a significant difference between the overall mean scores of the pre-test and post-test at 5% level of significance supporting the hypothesis: Parental knowledge of concussion symptoms, treatment, and long-term sequelae will increase after participation in an educational program on concussions. The significance at 5% level also suggests that the difference in the mean scores of

the pre-test and post-test was due to the effect of the materials and the program, not due to chance.

Figure 17

Participant	Occupation
Answers	
1	Insurance Agent
2	Guidance Secretary
3	Dept. Manager
4	Financial Advisor
5	Professor
6	Business Manager
7	Mental Health Therapist
8	Teacher
9	Wellness Coordinator
10	Dialysis Technician
11	Dental Hygienist
12	Operations Manager
13	School Administrator
14	Pharmacist
15	House Wife
16	Academic Advisor
17	Accountant
18	AD
19	Teacher
20	Accountant
21	Coach
22	Nurse
23	Accountant
24	Professor
25	Manager
26	Social Worker
27	Athletic Director
28	Manager
29	Computer Operator
30	Electrician

31	Executive
32	Teacher
33	Government Contracting Specialist
34	RN
35	Shipping Manager
36	Teacher
37	Teacher
38	?
40	Senior Administrative Assistant
41	Plant Maintenance

Figure 18

t-Test: Two-Sample Assuming Equal Variances

	PRE-TEST	*POST-TEST*
Mean	27.55	29.35
Variance	4.254	2.028
Observations	40	40
Pooled Variance	3.141	
Hypothesized Mean Difference	0	
df	78	
t Stat	-4.542	
P(T<=t) one-tail	9.9×10^{-6}	
t Critical one-tail	1.665	
P(T<=t) two-tail	1.9×10^{-5}	
t Critical two-tail	1.991	

Looking at the difference between PRE and POST

95% Confidence Interval	**1.8 ±**	0.773	**Difference**
Lower	**1.8 -0.773**	1.027	**(POST-PRE)**
Upper	**1.8 + 0.773**	2.573	

Parents demonstrated a high level of knowledge in regards to the inability to return to play the same day as injury and a variable recovery time from person to person. The following symptoms were answered correctly by all participants of the pre-test demonstrating a high level of knowledge in this area: headache, dizziness, difficulty concentrating, inability to describe time/place, and problems with vision. Overall, 62.5 % of the questions showed improvement from pre-test to post-test. The questions that showed the most significant improvement were required coaches training (21.9 % improvement), lowered pulse rate (22.7% improvement), difficulty falling asleep (29% improvement), sinus congestion (23.1 % improvement), and feelings of euphoria (26.3 % improvement). It should be noted that there are still some areas that need more improvement even after the educational presentation including lowered pulse rate (32.5 % wrong on post-test), hearing voices (60 % wrong on the post-test), seizures (30 % wrong on post-test), and feelings of euphoria (40 % wrong on the post-test). There were four questions that showed a decline from pre-test to post-test including return to play the same day (2.5% decline), seizures (20% decline), nauseous (2.6% decline) and problems with vision (2.5% decline). This educational program should be modified to ensure that these symptoms are recognized correctly by the parents.

There were 12 parents who had a child with a history of a concussion. They had a mean difference of 1.83 from pre-test to post-test. There were 28 parents with no children with a history of concussion. They had a mean difference of 1.79. This demonstrated that there was not a significant difference in knowledge (.04) in parents who had previous experience with concussion compared with those parents who did not have previous experience.

Comparisons were made between mothers and fathers. There were 11 fathers with a mean pre-test score of 26.09 and mean post-test score of 29.09. This resulted in a mean difference of

3. There were 29 mothers with a mean pre-test score of 28.10 and a mean post-test score of 28.45. The mean difference was 1.35. The fathers demonstrated a larger improvement in knowledge, but started with a lower mean score in the pre-test. The mothers started with a higher pre-test mean score but show smaller improvement and did not score as high on the post-test. This could indicate that mothers had an initial higher level of concussion knowledge but fathers responded better to the presentation. Future studies should compare equal numbers of mothers and fathers and adjust the educational program toward the target audience. It is recommended that the questions should be looked at with greater detail and the presenter should adjust the presentation if there are more fathers present. It is recommended that separate sessions for mothers and fathers should be considered.

There were five sports including football (17), track (15), volleyball (22), soccer (9), baseball/softball (14), and wrestling (3) that were analyzed for this study. The initial inclusion criteria listed cheerleading however; there were no participants who had a child in that sport. Every group demonstrated some level of knowledge improvement from pre-test to post-test.

The parents with a child in wrestling showed the lowest mean pre-test score of 26.67 but also demonstrated the biggest improvement with a mean post-test score of 30.33. This is a difference of 3.66. It should be noted that this group also had the least amount of participants (3). The parents that began with the highest level of knowledge were the baseball/softball group (14). They began with a mean pre-test score of 28 and a mean post-test score of 29.07. This was the smallest mean difference of 1.07. The participants who had a child in football (17) had a mean pre-test score of 27.65 and mean post-test score of 30. This is a mean difference of 2.35. Track, volleyball, and soccer all show improvement with mean differences between the lowest of 1.07 and the highest of 3.67. The data shows that the participants with the greatest post-test

improvement were those who had a child in wrestling and football, with wrestling demonstrating the highest post-test score. The questionnaire did not include questions in regards to which sports parents felt had the highest risk for concussion. This could be considered for future studies. Parents may focus more on the educational program if they feel that the sport their child participates in has a higher risk of concussion.

Limitations

The small sample size and the limited rural area hinders the generalization of this study to the entire population of parents with a high-school athlete (7-12th grade) participating in football, soccer, track, volleyball, wrestling, baseball/softball, or basketball. Cheerleading could not be included in the analysis due to the lack of participants from this sport. The study was done on two very small rural schools. It was very difficult to attract participants for the study despite advertising on social media, by brochure, word of mouth, and contact with the athletic director, trainer, and coaches. The educational presentation was taken to booster meetings to be able to enlist participants. Each meeting had many other topics on the agenda and the parents may have completed the questionnaires in haste in order to get to the rest of the meeting. The booster meetings were held in different locations. Some of the areas were loud and had distractions that could have affected the parental focus on the presentation.

Conclusions

The review of literature exhibits a lack of parental knowledge of concussion symptoms, treatment, and long-term sequelae in parents of high-school athletes. Although there are laws in Pennsylvania stating that concussion education is mandatory for coaches and athletic trainers, it is not mandatory for parents. This study indicates that an educational program improves the

knowledge of concussion in parents of high-school athletes. It is recommended that school districts should consider required educational training for parents before their child participates in sports that have a high risk for concussions.

Chapter 5

Summary, Conclusions, and Recommendations

Summary of Findings

"Brain injury is the leading cause of death and disability in children and adolescents," (BrainSTEPS, 2015, Brain injury facts section, para. 1). According to the Brain Injury Association of America (2015), ages 0-4 and 15-19 are the two age groups at greatest risk for traumatic brain injury or TBI. Approximately 3.8 million sports- and recreation-related concussions occur every year, with seventy percent occurring in youth ages 10-19 years (Kurowski, Pomerantz, Schaiper, & Gittelman, 2014). Literature shows that five out of ten concussions are not reported or go undetected (UPMC Sports Medicine Concussion Program, 2015). In addition, youth athletes often under-report symptoms because they do not understand the seriousness of a concussion and are fearful of being removed from the sport they are taking part in (Bloodgood et al., 2013). According to Coghlin, Myles, & Howitt (2009), it is important to recognize a concussion, even a minor one, because the possibility of experiencing a second one is increased and the symptoms may be even more severe and take longer to resolve. A review of the literature indicated that there is a lack of parental knowledge in identifying concussion symptoms (Coghlin, Myles, & Howitt, 2009; Gourley, Bay, & McLeod, 2010; Stevens, Penprase, Kepros, & Dunneback, 2010). In order to seek appropriate treatment for their children related to concussions, parents need to have adequate knowledge.

The purpose of this pre-test and post-test program evaluation was to evaluate the effectiveness of an educational program to improve parental knowledge of concussions using a pre-test and post-test design. The sample consisted of 40 parents of athletes in grades 7-12 enrolled in football, basketball, volleyball, baseball/softball, soccer, track, wrestling, or

cheerleading in two rural school districts in Northwestern Pennsylvania. It was noted that there were not any parents of cheerleaders in any of the educational sessions. Data collection was planned for two educational sessions that were well advertised to parents via pamphlets, coaches, the athletic director, word of mouth, and the school-based web site. Because of low participation in these programs, the investigators took the program to the parents by attending various booster meetings in order to make it more convenient for the parents. There were 40 parents who participated in the educational program, and all 40 pre-tests and post-tests were returned for a 100% response rate.

Data analysis using a paired t-Test demonstrated that a mean of 27.55 questions were answered correctly in the pre-test and a mean of 29.35 questions were answered correctly in the post-test. This demonstrated a mean difference of 1.8 questions. There was strong evidence ($t=2.02$, $p=.00005$) to support the hypothesis that participating in the education program on concussions will improve parental knowledge of concussion symptoms, treatment, and long-term sequelae.

The data was also analyzed further by comparing the knowledge of fathers versus mothers. The fathers demonstrated a larger improvement in knowledge, but started with a lower mean score in the pre-test. The mothers started with a higher pre-test mean score, but showed smaller improvement and did not score as high on the post-test. This could mean that mothers had an initial higher level of concussion knowledge but fathers responded better to the presentation. There was not a significant difference in knowledge in parents who had previous experience with concussion compared with those parents who did not have previous experience.

When data analysis looked at specific questions asked, 62.5% of the questions showed an improvement from pre-test to post-test. The questions that showed the most significant

improvement were required coaches training, lowered pulse rate, difficulty falling asleep, sinus congestion, and feelings of euphoria. It was noted that four questions showed need for improvement and four questions showed a decline. It is recommended that the educational program should be modified to ensure that these symptoms are recognized by the parents.

Lastly, when looking at each individual sport, every group demonstrated some level of knowledge improvement from pre-test to post-test. The parents with children in wrestling and football showed the biggest post-test improvement.

Malcolm Knowles' Adult Learning Theory, also called andragogy, was used to guide this project's educational program on concussions, specifically focusing on the experience and motivation of the parents being addressed. In order to touch upon each learning style, various methods for the educational program were used. The educational sessions strived to keep the presentations to a 30-45 minute time frame, but when turnout for the educational sessions was lower than anticipated, the sessions were "added on" to booster meetings. This increased the length of time the audience needed to be seated, which may have distracted some of the audience. Furthermore, questionnaires may have been completed in haste in order to get to the rest of the meeting. Some of the meeting environments were also loud and had distractions that could have affected the parents' focus on the presentation. Content was aimed specifically at parents who had children in sports, which made the learning experience more meaningful and helpful to the parents. This theory should help guide future presentations in order to enhance the parents' ability to focus on the content presented.

Implications for Nursing

Pennsylvania law states concussion education is mandatory for coaches and athletic directors, but it is not mandatory for parents. Because literature shows that there is a lack of

parental knowledge of concussion symptoms, athletes do not report possible concussions, and concussions go undiagnosed, it is important that parents are able to recognize the signs and symptoms of concussion so the athlete receives proper treatment.

Health effects of an undiagnosed concussion can include Second-Impact Syndrome (SIS). This occurs when one receives a second head injury before the brain has time to recover from the first one. High-school athletes are in more danger of SIS due to their age, type of sport, and prior history of concussion (Cobb & Battin, 2004). Repeated mild concussions that occur over months or years can result in neurological and cognitive deficits (Centers for Disease Control and Prevention, 2016). Repeated mild concussions that occur within hours, days, or weeks can be devastating or even fatal (Centers for Disease Control and Prevention, 2016).

According to the Centers for Disease Control and Prevention (2015), other health effects include cognitive deficits such as problems with attention, learning and memory, planning, decision making, reaction time, reasoning and judgement, and communication. Behavioral changes can occur such as mood disturbances, delusions, hallucinations, agitation, confusion, and impulsivity. Motor effects such as changes in muscle tone, paralysis, changes in balance, and impaired coordination can occur. Lastly, sensory changes may arise such as sensitivity to light, changes in vision and hearing, and other symptoms such as headache, fatigue, sleep disturbances, and chronic pain (Centers for Disease Control and Prevention, 2015).

In addition to health effects, functional, economic, and societal impacts can develop. Long-term impairment with psychological and neurological disorders can affect the individual with return to school, work, and other pre-injury activities (Centers for Disease Control and Prevention, 2011). TBI can put an individual at risk for long-term effects such as epilepsy, Alzheimer's disease, Parkinson's disease, and other brain disorders that become more

predominant with aging (Centers for Disease Control and Prevention, 2016). These long-term effects can potentially affect an individual's self-worth and self-perceived productive role in society (Centers for Disease Control and Prevention, 2011).

While a concussion not only affects the individual and family, through adverse health and functional effects, it impacts society with an economic burden estimated at $76.5 billion in direct and indirect medial costs (Centers for Disease Control and Prevention, 2011, 2016). "The cost of fatal TBIs and TBIs requiring hospitalization, many of which are severe, account for approximately 90% of the total TBI medical costs" (Centers for Disease Control and Prevention, 2016, Severe TBI section, para. 3).

While every individual may be impacted differently by a TBI, there are interventions available to help limit the effects of this injury. These interventions include "primary prevention, early management, and treatment of severe TBI" (Centers for Disease Control and Prevention, 2016, Meeting the Challenge of Severe TBI section, para. 1). Schools are in an optimal position to provide concussion education programs to parents to educate them on recognition of concussion symptoms, treatment, and long-term sequelae and help reduce morbidity from TBIs.

Recommendations for Further Research

Replication of this study is recommended with a larger sample size. This study looked specifically at two small schools in a rural area of Northwestern Pennsylvania. It would be beneficial to look at larger, urban schools and compare them to rural schools to see if there is a lack of parental knowledge of concussion symptoms between urban and rural schools. It would also be of interest to see if concussion programs for parents are being implemented in larger, urban school districts.

This study showed a decline in four questions from pre-test to post-test including return to

play the same day (2.5% decline), seizures (20% decline), nausea (2.6%), and problems with vision (2.5% decline). It is recommended that future educational programs be modified to ensure that these symptoms are recognized correctly by the parents. In addition, because this study found that fathers demonstrated a larger improvement in knowledge with a lower mean score in the pre-test and mothers started with a higher pre-test score but showed a smaller improvement on the post-test, future studies should compare equal numbers of mothers and fathers and adjust the educational program toward the target audience. Questions should be looked at with greater detail and the educator should adjust the presentation if there are more fathers present. Having separate sessions for mothers and fathers should also be considered.

Another suggestion is to modify the questionnaire to include questions in regards to which sport parents felt had the highest risk for concussion. Parents may focus more on the educational program if they feel that the sport their child participates in has a higher risk of concussion.

In addition, this study looked specifically at a targeted age group of athletes, male and female, in grades 7-12 enrolled in football, basketball, volleyball, wrestling, baseball/softball, soccer, track or cheerleading. Future studies may want to look at different age groups, such as athletes from five to twelve years old. As suggested by Coghlin, Myles, and Howitt (2009) parents of athletes in this age group may be less knowledgeable about concussion symptoms because they are not yet concerned about concussions in their children. Furthermore, although cheerleading was part of the original inclusion criteria, it was noted that there were not any parents of cheerleaders in any of the educational sessions. It is recommended that parents of cheerleaders be included in future studies.

Lastly, it was found through the literature review that adolescent athletes hesitate or do not report concussion symptoms. Although, this study looked specifically at parental knowledge

of concussion symptoms, treatment, and long-term sequelae, it would be of great benefit for future studies to examine why athletes do not report symptoms and aim concussion educational programs at the athletes to determine if there is an improvement in reporting and earlier treatment.

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Appendix A (Questionnaire)

Demographic Information

Study Participant Number: _____

Occupation: _____

Sport(s) your child participates in: _____

What grade is your child in? _____

Child's age: _____

a) Have you/do you participate in high level (pro or semi pro), medium (competitive leagues), or low level (recreational sports)? (circle one)

High level

Medium level

Low/rec level

No sport participation

b) What is your status of guardianship to the participating child? (circle one)

Mother

Father

Male Legal Guardian

Female Legal Guardian

c) Has your child ever suffered from a concussion in the past? (circle one)

Yes No

Questionnaire (answers in bold)

1) Does a loss of consciousness determine whether a concussion has occurred? (circle one)

Yes **No**

2) Can a player who has suffered a concussion return to play in the same day? (circle one)

   Yes **No**

3) A concussion may be caused by a blow to the neck, jaw, or elsewhere on the body? (circle one)

   Yes No

4) Is it necessary for a player to be medically evaluated after having their bell rung? (circle one)

   Yes No

5) A CT scan is required to diagnose a concussion? (circle one)

   Yes **No**

6) Pennsylvania law requires that all coaches receive concussion training? (circle one)

   Yes No

7) Pennsylvania law requires that all athletes removed from play for suspected concussion be examined by a health care provider before returning to play? (circle one)

   Yes No

8) Severe brain damage can occur if an athlete returns to play too soon after sustaining a concussion? (circle one)

   Yes No

9) Recovery time varies from person to person? (circle one)

   Yes No

10) The following are signs and symptoms of concussion:

    (Please circle True or False)

    T F Headache

T	F	Neck pain
T	**F**	Difficulty with urination
T	F	Dizziness
T	**F**	Lowered pulse rate
T	F	Ringing in the ears
T	F	Difficulty falling asleep
T	F	Slurred speech
T	F	Difficulty concentrating
T	F	Drowsiness/fatigue
T	F	Hearing voices
T	**F**	Sinus congestion
T	F	Inability to describe time and place
T	F	Seizures
T	F	Feelings of euphoria
T	**F**	Inability to swallow
T	**F**	Chest pain
T	F	Feeling of “pressure” in the head
T	F	Difficulty with memory
T	F	Feeling nauseous
T	F	Problems with vision
T	F	Increased emotion/irritability
T	F	Increased sleeping

Appendix B (Copyright Permission)

Hi Melanie,

Sorry for delay.... just returning from Vacation.

Absolutely you can use, and modify the questionnaire as required.

If you would like my assistance with your project in a more meaningful way I would be happy to help in any way I can.

Best,

S

Dr. Scott Howitt
BA, CK, MSc, DC, FRCCSS(C), FCCPOR
Associate Professor CMCC
Supervising Clinician Sunnybrook St. John's Rehab
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Appendix C (Permission Letter)

North Clarion County Schools
10439 Route 36
Tionesta, Pennsylvania 16353-9199
High School Office (814) 744-8544 or (814) 744-8737 • Fax (814) 744-8762

Steven L. Young, Superintendent
Vanessa L. Weinlein, High School Principal
Erika K. West, Guidance Counselor

September 2016

As Superintendent of North Clarion County School District, I give permission for Melanie Best and Pam Karg to conduct a concussion study with parents at North Clarion School District. This authorization includes the requirement that no identifying information on students, teachers, or parents be included in the study findings or presentations. Confidentiality must be maintained as an understanding of our agreement to participate in this study.

Please feel free to contact me with any questions.

Mr. Steven Young

Appendix D (Permission Letter)

Clarion Area School District
Dedicated to Excellence!

Michael L. Stahlman, *Superintendent*
Jill M. Spence, *Business Manager*

221 Liberty Street
Clarion, PA 16214-1809
Phone (814) 226-6110
Fax (814) 226-9292

June 14, 2016

Edinboro University of Pennsylvania
219 Meadville, Street
Edinboro, PA 16444

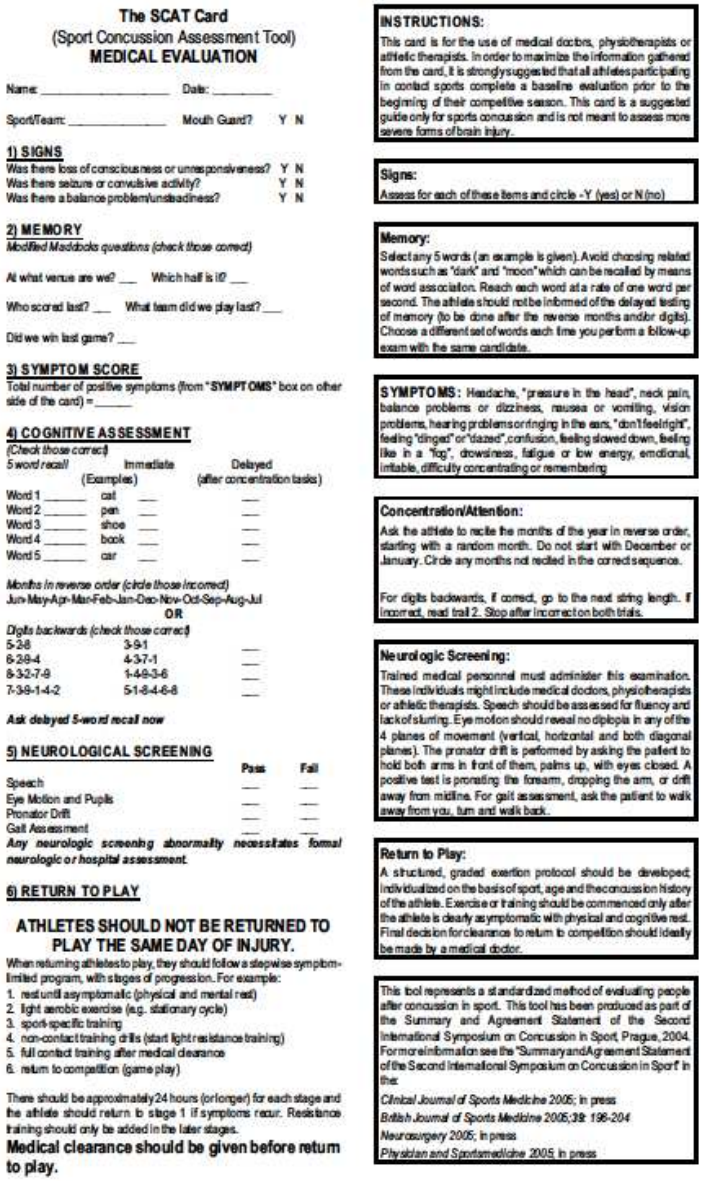
Edinboro IRB:

I am writing to give permission to Pam Karg and Melanie Best to conduct Concussion Education /Study Program for the parent of Clarion Area School District.

Sincerely,

Michael L. Stahlman Ed.D
Superintendent

Appendix E (SCAT tool)



The SCAT Card
(Sport Concussion Assessment Tool)
MEDICAL EVALUATION

Name: _____ Date: _____

Sport/Team: _____ Mouth Guard? Y N

1) SIGNS
Was there loss of consciousness or unresponsiveness? Y N
Was there seizure or convulsive activity? Y N
Was there a balance problem/unsteadiness? Y N

2) MEMORY
Modified Maddocks questions (check those correct)

At what venue are we? ___ Which half is it? ___

Who scored last? ___ What team did we play last? ___

Did we win last game? ___

3) SYMPTOM SCORE
Total number of positive symptoms (from "**SYMPTOMS**" box on other side of the card) = _____

4) COGNITIVE ASSESSMENT
(Check those correct)

5 word recall	Immediate (Examples)		Delayed (after concentration tasks)
Word 1 _____	cat	___	___
Word 2 _____	pen	___	___
Word 3 _____	shoe	___	___
Word 4 _____	book	___	___
Word 5 _____	car	___	___

Months in reverse order (circle those incorrect)
Jun-May-Apr-Mar-Feb-Jan-Dec-Nov-Oct-Sep-Aug-Jul

OR

Digits backwards (check those correct)

5-2-8	3-9-1	___
6-2-9-4	4-3-7-1	___
8-3-2-7-9	1-4-8-3-6	___
7-3-9-1-4-2	5-1-8-4-6-8	___

Ask delayed 5-word recall now

5) NEUROLOGICAL SCREENING

	Pass	Fail
Speech	___	___
Eye Motion and Pupils	___	___
Pronator Drift	___	___
Gait Assessment	___	___

Any neurologic screening abnormality necessitates formal neurologic or hospital assessment.

6) RETURN TO PLAY

ATHLETES SHOULD NOT BE RETURNED TO PLAY THE SAME DAY OF INJURY.

When returning athletes to play, they should follow a stepwise symptom-limited program, with stages of progression. For example:
1. rest until asymptomatic (physical and mental rest)
2. light aerobic exercise (e.g. stationary cycle)
3. sport-specific training
4. non-contact training drills (start light resistance training)
5. full contact training after medical clearance
6. return to competition (game play)

There should be approximately 24 hours (or longer) for each stage and the athlete should return to stage 1 if symptoms recur. Resistance training should only be added in the later stages.

Medical clearance should be given before return to play.

INSTRUCTIONS:
This card is for the use of medical doctors, physiotherapists or athletic therapists. In order to maximize the information gathered from the card, it is strongly suggested that all athletes participating in contact sports complete a baseline evaluation prior to the beginning of their competitive season. This card is a suggested guide only for sports concussion and is not meant to assess more severe forms of brain injury.

Signs:
Assess for each of these items and circle -Y (yes) or N (no)

Memory:
Select any 5 words (an example is given). Avoid choosing related words such as "dark" and "moon" which can be recalled by means of word association. Reach each word at a rate of one word per second. The athlete should not be informed of the delayed testing of memory (to be done after the reverse months and/or digits). Choose a different set of words each time you perform a follow-up exam with the same candidate.

SYMPTOMS: Headache, "pressure in the head", neck pain, balance problems or dizziness, nausea or vomiting, vision problems, hearing problems or ringing in the ears, "don't feel right", feeling "dinged" or "dazed", confusion, feeling slowed down, feeling like in a "fog", drowsiness, fatigue or low energy, emotional, irritable, difficulty concentrating or remembering

Concentration/Attention:
Ask the athlete to recite the months of the year in reverse order, starting with a random month. Do not start with December or January. Circle any months not recited in the correct sequence.

For digits backwards, if correct, go to the next string length. If incorrect, read trail 2. Stop after incorrect on both trials.

Neurologic Screening:
Trained medical personnel must administer this examination. These individuals might include medical doctors, physiotherapists or athletic therapists. Speech should be assessed for fluency and lack of slurring. Eye motion should reveal no diplopia in any of the 4 planes of movement (vertical, horizontal and both diagonal planes). The pronator drift is performed by asking the patient to hold both arms in front of them, palms up, with eyes closed. A positive test is pronating the forearm, dropping the arm, or drift away from midline. For gait assessment, ask the patient to walk away from you, turn and walk back.

Return to Play:
A structured, graded exertion protocol should be developed; individualized on the basis of sport, age and the concussion history of the athlete. Exercise or training should be commenced only after the athlete is clearly asymptomatic with physical and cognitive rest. Final decision for clearance to return to competition should ideally be made by a medical doctor.

This tool represents a standardized method of evaluating people after concussion in sport. This tool has been produced as part of the Summary and Agreement Statement of the Second International Symposium on Concussion in Sport, Prague, 2004. For more information see the "Summary and Agreement Statement of the Second International Symposium on Concussion in Sport" in the:

Clinical Journal of Sports Medicine 2005; in press
British Journal of Sports Medicine 2005;39: 196-204
Neurosurgery 2005; in press
Physician and Sportsmedicine 2005 in press

Appendix F (Consent Form)

EDINBORO UNIVERSITY OF PENNSYLVANIA

Edinboro, Pennsylvania

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Study Title: Concussion Education

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Introduction: You are being asked by Pamela Karg and Melanie Best to be in a research study. You should understand that this study involves research. This consent describes your role as a participant in the study.

Purpose: The aim of this study is to evaluate the effectiveness of an educational plan on concussion symptoms, treatment and long-term sequelae for parents of high-school athletes. All data will be collected today and there will be no follow-up needed.

What will happen during the study?: I will be asked to complete a questionnaire prior to and after completing an educational program on concussion. My name is not included on the questionnaire.

Risks: There are no known foreseeable risks or discomforts involved in participating in this study.

Benefits: There will be no direct benefit to me from participating in this research study.

Cost/Payment: There will be no cost or payment to participate in this study.

Confidentiality: All data will be kept confidential and only the primary researchers and research committee will have access to the data. The data will be kept locked while not in use. No individual identities will be used in any reports or publications resulting from the study.

What happens if I have more questions?: Your questions about a research-related injury or the research study will be answered by Melanie Best or Pamela Karg at numbers listed above. If you have a question about your rights as a research participant that you need to discuss with someone, you can call the Edinboro University Institutional Review Board at (814) 732-2856 or at irb-chair@edinboro.edu

PARTICIPATION IN RESEARCH STUDY IS VOLUNTARY. I am free to decline to participate in this research study, or I may withdraw my participation at any point without penalty. I have had a chance to consider the study, ask questions and understand

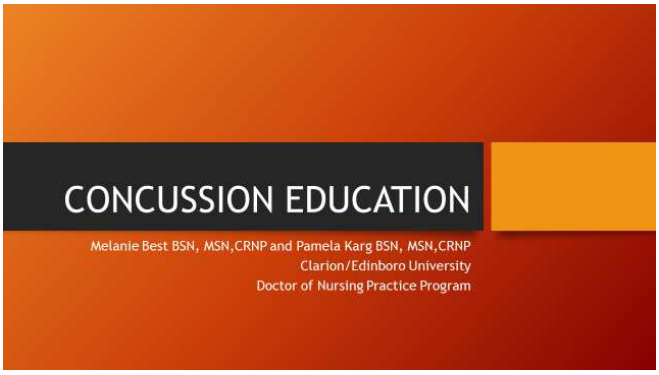
that my participation is voluntary. I am at least 18 years of age. I have been given a copy of the consent for my own records.

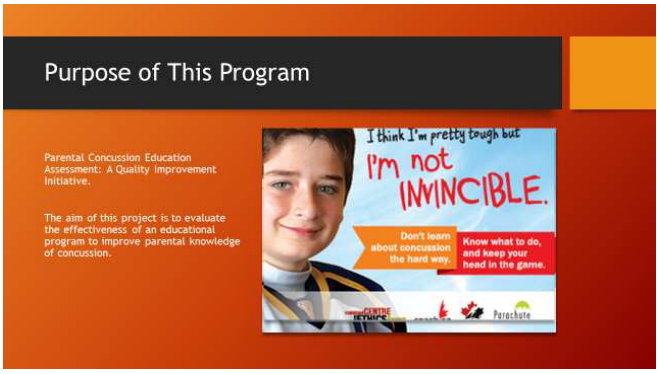
Signature _____ (Participant) Date _____

Signature _____ (Investigator) Date _____

IRB Research Approval #___EU201645_____

Appendix G (PowerPoint Presentation)





CONCUSSION STATISTICS

- 1.6-3.8 million concussions occur each year. (CDC, 2011a)
- 20-60% of athletes do not report concussion symptoms. (Chrisman et al, 2012)
- The literature indicates that there is a lack of parental knowledge in identifying concussion symptoms. (Coghlin et al, 2009)
- Concussions that go undetected can result in serious or even permanent damage.

What is a Concussion?

A type of traumatic brain injury caused by a bump, or jolt to the head or by a hit to the body that causes the brain to bounce around or twist in the skull, stretching and damaging the brain cells and creating changes in the brain.

(Centers for Disease Control and Prevention, 2015, para.1)

Four Categories of Concussion Symptoms

- Physical
- Cognitive
- Emotional
- Sleep

Physical Symptoms

Physical Symptoms
- Headache
- Nausea/Vomiting
- Balance Problems
- Dizziness
- Fatigue
- Ringing in the Ears
- Sensitive to Light
- Numbness/Tingling
- Dazed/Confused
- Neck Pain

(Centers for Disease Control, 2015)

Cognitive Symptoms

Cognitive Symptoms
- Mentally foggy
- Feeling slowed down
- Difficulty concentrating
- Difficulty remembering
- Forgetful of recent info or conversations
- Confused about recent events
- Answers questions slowly
- Repeats questions

(Centers for Disease Control, 2015)

Emotional Symptoms

Emotional signs
- Irritability
- Sadness
- More emotional
- Nervousness

(Centers for Disease Control, 2015)

Sleep Symptoms

Sleep
- Drowsiness
- Sleeping less than usual
- Sleeping more than usual
- Trouble falling asleep

(Centers for Disease Control, 2015)

What if My Child Gets Injured?

- If a concussion is suspected the child must be removed from play immediately.
- They may not go back into the game that same day.
- A sideline evaluation should be done by trainer.

(Pennsylvania Medical Society, 2013)

Pennsylvania Laws

- Any student with sign of concussion must be removed immediately and cannot return until examined by medical professional.
- Coaches are required to receive concussion training.
- Parents and student athletes must sign a form stating that they have received and read information sheet on concussion and traumatic brain injury prior to sport season.

(Pennsylvania Medical Society, 2013)

Diagnosis of Concussion

- Concussion is diagnosed by symptoms and injury.
- CT Scan or MRI can rule out fracture and brain bleed but they do not diagnose concussion.
- IMPACT testing should be done prior to sports season. This will be used to compare results after an injury to check cognitive ability and function.
- Your health care provider will do an exam and ask several questions. You may be referred to specialist or for Physical Therapy.

Recovery from Concussion

- Cognitive and physical rest is the cornerstone of concussion management and recovery. (Halstead & Walter, 2010)
- Recovery time varies but should be more conservative with children and adolescents, including a longer asymptomatic period before return to play. (Scorza, Raleigh, & O'Connor, 2012)

Recovery

Rest is important. This includes no electronics such as T.V., radio, i-pod, cellphone, computer, video games, headphones ect. for a period of time determined from your health care provider.

Limit schoolwork and avoid testing in the first few weeks following concussion.

(Scorza et al., 2012)

Recovery

Avoid exercise, sports or strenuous activity until symptom free for at least 1 week then return to activity very slowly.

Monitor very closely for symptoms to return.

Second-Impact Syndrome(SIS)

This happens when one receives a second head injury before the brain has had time to recover from the first one.

Condition can deteriorate quickly due to rapid swelling of the brain.

This is why an athlete must allow enough time to recover before return to play.

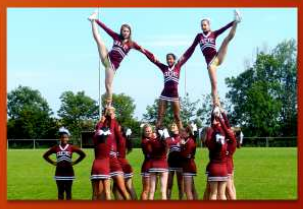
(Cobb & Battin,2004)

Protect your Athlete

Know the signs and symptoms of concussion.

Do not push your athlete to return to play before they are ready.

Encourage your athlete to report symptoms immediately.



Where Can I Learn More About Concussion?

http://www.cdc.gov/headsup/

Questions?????

Thank You for Your Attendance

References

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