A CONCUSSION TOOLKIT EDUCATIONAL SESSION: PROMOTING EVIDENCE-BASED MANAGEMENT OF YOUTH CONCUSSION IN A RURAL PRIMARY CARE SETTING

A Dissertation
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science

By

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In Partial Fulfillment of the Requirements
for the Degree of
DOCTOR OF NURSING PRACTICE

Major Department:
Nursing

March 2018

Fargo, North Dakota

North Dakota State University
Graduate School

Title

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

DOCTOR OF NURSING PRACTICE

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ABSTRACT

Concussions are a form of mild traumatic brain injury, yet the potential short-term and long-term adverse effects are anything but mild. Concussions, especially if left undiagnosed or untreated, can adversely affect a student's scholastic achievements, relationships, emotions, and long-term health outcomes. Despite the recent surge in concussion awareness, literature substantiates a gap in the knowledge and adherence to published concussion guidelines amongst primary care providers. Rural communities, with a lack of access to specialty providers, rely on primary care providers to ensure youth concussions are appropriately evaluated and managed to reduce both the short-term and long-term negative health outcomes associated with concussions.

This practice improvement project (PIP) focused on increasing primary care providers' knowledge and promoting evidence-based concussion management practices in two rural North Dakota communities. Through implementation of the PIP, rural primary care providers were educated on the latest evidence-based concussion management guidelines, given resources for clinical practice, and provided an opportunity to evaluate and treat a mock-concussion patient.

Project implementation was comprised of a concussion educational session, which included concussion education and the introduction of a concussion toolkit, and a return skill demonstration, where providers applied their acquired concussion evaluation and management strategies on a mock-concussion patient. To assess the participants' perceived self-confidence and likelihood of using evidence-based practices when evaluating and managing patients with concussions, a self-confidence evaluation survey was administered. The providers were also evaluated on their ability to evaluate and treat a concussion patient during the return skill demonstration.

The results of the project indicated an overall increase in participant knowledge, self-confidence, and likelihood of following concussion management guidelines in their next encounter with a patient suspected of suffering from a concussion. The educational session, concussion toolkit, and return skill demonstration were effective interventions in promoting the use of concussion management guidelines by primary care providers in the rural clinic setting.

ACKNOWLEDGEMENTS

I would like to extend a special thank you to my dissertation chair and advisor, Dr. Dean Gross, for his ongoing guidance and support. Even before given the title as my dissertation chair, he was my go-to person for guidance along this journey. His knowledge, passion, creativity, and patience have been paramount to my success in completing my dissertation. To my committee members, Dr. Tina Lundeen, Amy Gotvaslee, and Dr. Shannon David; thank you for providing your ideas, constructive feedback, positive attitude, time, and dedication to my project.

I would also like to thank my former Medcenter One College of Nursing (MCON) professor and present Director of Nursing at NDSU Bismarck, Wendy Kopp. Just four years ago, I walked into your office looking for guidance, and I left with the courage to become a nurse practitioner. Not only did I receive the best undergraduate nursing education from you and the rest of my MCON professors, but you placed opportunities in front of me and showed me the doors that might be useful to open.

To the participating clinics' health care staff at both Linton Hospital and Clinics and Washburn Family Clinic, thank you for allowing to implement my practice improvement project at your clinic. To the providers, thank you for offering your valuable time, your willingness to participate in this project, and commitment to providing evidence-based care to your patients.

To my friends and fellow Doctor of Nursing Practice classmates, we have formed an indescribable bond throughout this journey, and I want to thank you all for your encouragement and support during the disquisition process. Kelsey Striefel and Taylor Mueller, you listened to me complain, cheered me on during my accomplishments, and assisted me during the implementation and formatting process. I am beyond thankful for our friendship and your support through this process.

Thank you to my parents, Ken and Brenda, who instilled in me the core values of determination and hard work. Your enduring support and unconditional love throughout my accomplishments and failures has ultimately led me to where I am today. And, Mom, just like you had hoped, I danced.

I would also like to thank to my in-laws, Bryan and Lorraine. The love, support, and guidance provided to Luke and I throughout our marriage and my education has been unwavering and a true blessing.

Last, but not least, I want to thank Jesus Christ for always walking by my side and God for guiding me on this arduous, but rewarding, journey. Thank you for everything and everyone in this beautiful life and the talents and opportunities I have been gifted. To be able to use my God-given talents by comforting and caring for others' whether they are at their best or worst, is an absolute blessing. As a (future) nurse practitioner, I hope that patients may see something of His love in how I treat them.

DEDICATION

I want to dedicate this disquisition to my husband, Luke, who challenged himself and made changes for the better along with me during graduate school. It has been a blessing having a husband who provides constant love, support, encouragement, and who knows when to provide fun and distraction at just the right time. To all the dreamer women out there like myself, find yourself a spouse who tells you, "you can do anything you set your mind to." And, because he's a realist, we both know it's the truth.

This disquisition is also dedicated to my football-playing little brother Dillon, whose concussions, unfortunately, were the inspiration behind this practice improvement project.

To my future children: Going back to DNP school was as much for you as it was for me. I wanted to be your example of what hard work, passion, kindness, and the support of loving family and friends will allow you to achieve: your wildest dreams! But I promise you this, achieving your dreams will never be easy, so, as Chris Ledoux would say, you have to be tougher than the rest. I find myself imagining the mom I hope to be for you. That mom, she's a tall order. But, I promise you this, I (and your dad) will love and guide you in all its best forms.

Lastly, I dedicate this disquisition to myself. I thought this practice improvement project would be the death of me, yet here I am. I never knew how much grit and determination I possessed until I found myself working on this document late at night, early in the morning, and when I could have been enjoying the company of my husband, family, friends, dogs (Koda and Finnley), and the Missouri River instead.

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CHAPTER I. INTRODUCTION

Background

Concussion in youth sports has become a public health concern for the health care community, parents, schools, and state legislation over the past decade, as recent years have seen an increasing awareness and understanding that all concussions involve some level of traumatic injury to the brain and require evaluation and proper treatment to prevent the impact of concussion and persistent post-concussion complications (Graham, Rivara, Ford, & Spicer, 2014). Despite the surge in concussion awareness and education to the public and media, a considerable gap in the knowledge and adherence to concussion management guidelines amongst primary care providers (PCP) remains problematic, indicating a need for further education and easily-navigated, evidence-based management using comprehensive guidelines (Mrazik et al., 2015; Zemek et al., 2014). Primary care providers are increasingly becoming the primary health care professionals diagnosing and treating concussion (Lebrun et al., 2013), especially in rural communities where sports medicine, neurology specialties, and athletic trainers are lacking (Zonfrillo et al., 2012). Accurate concussion assessment, management, and the ability to make return to play and return to school recommendations is of importance to rural PCPs, because if not treated promptly and effectively, concussion may lead to short-term and long-term complications, such as second impact syndrome, post-concussion syndrome, or chronic traumatic encephalopathy (Harmon et al., 2013).

Recent estimates indicate that 1.6 to 3.8 million sport-related concussions occur in the United States (US) annually, and 5% to 10% of student athletes will experience a concussion during a sports season (Graham, Rivara, Ford, & Spicer, 2014; Halloran, 2015; Lynch, 2016). With a heightened awareness of concussion and state legislature mandating medical evaluation

after a suspected concussion in all 50 states, the reported incidence and need for concussion management already has, and will likely continue to increase (Arbogast et al., 2013; Harmon et al., 2013). Primary care providers had to become increasingly knowledgeable in the ability to diagnose and manage concussion in the rural setting without standard diagnostic tools and resources, and often with little or no training (Flaherty et al., 2016; Menjugas-MacDuff, 2015). A concise, current concussion algorithm and additional concussion education for the rural PCP with limited resources will likely be beneficial, therefore, improving the likelihood of best possible outcomes in patients who have experienced a concussion (Menjugas-MacDuff, 2015).

Purpose of the Project

The purpose of the proposed practice improvement project was to increase primary care provider awareness, knowledge, and confidence in recognizing and managing sports-related concussion in the rural clinic setting. Project implementation assisted rural primary care providers in the evaluation and evidence-based management of pediatric athletes with concussion through an educational session and the implementation of a concussion toolkit. The toolkit contained a concise algorithm based on an evidence-based practice guideline to assist in concussion diagnosis and management, including the Sports Concussion Assessment Tool 5th edition (SCAT5), return to play and return to school recommendations, as well as educational resources for the patient, parent, school, and coaching staff. In providing concussion education and implementing a concussion toolkit in rural primary care clinics, athletes in rural communities have the opportunity to receive the best care possible and be less likely to experience post-concussion complications.

Significance for Practice

The frequency in which a primary care provider, rather than an emergency department health care provider, diagnoses and treats a concussion in a young athlete has increased significantly in the past ten years as a result of increased concussion awareness efforts directed toward both providers and the general public. In fact, in 2013, the primary care clinic emerged as the leading location of health care delivery for young athletes with concussion (Taylor et al., 2015), with over 94% of PCPs seeing, assessing, and managing them (Lebrun et al., 2013). In addition, youth sports concussions, being a growing public health concern, resulted in state legislatures passing concussion management laws in all 50 states since 2009, mandating clearance by a health care professional before returning to play. The enacted laws have, and will continue to, increase the number of concussed student athletes seeking both treatment and medical clearance, requiring PCPs to be up-to-date and knowledgeable in evidence-based guidelines to allow for safe return to play (Zonfrillo et al., 2012). The recent surge in concussion awareness has resulted in rapidly evolving published research and practice guidelines on concussion, leaving PCPs, especially those practicing in rural settings, often uncertain as to which guideline is best suited for their practice (Menjugas-MacDuff, 2015).

Youth Sports Concussion State Laws

Youth sports concussion laws have played a critical role in developing a culture of change in youth sports by increasing concussion awareness, and hopefully, limiting long-term adverse health effects for student athletes with concussion. Youth sports concussion laws are similar across the US, focusing on the recognition of concussion, management of post-concussion syndrome, and preventing complications. Concussion laws, including North Dakota's Concussion Management law, contain three main provisions: (1) distribution of concussion

education to athletes, parents, and coaches; (2) immediate participation removal of suspected concussed athlete; and (3) evaluation of athlete by a designated health professional before returning to play (Harvey, 2013; Lowrey & Morain, 2014). The laws' provisions, especially the educational component, may not be sufficient to decrease the prevalence and severity of concussions. Oftentimes, a signed information sheet acknowledging concussion risks by both the student athlete and parent passes as annual mandatory education. An effective concussion program for student-athletes and parents is yet to be determined (Bagley et al., 2012). Therefore, passive education approaches, such as what is currently being implemented by the North Dakota High School Activities Association (NDHSAA) (NDHSAA, 2013), may be lacking athlete and parent accountability, and unlikely to encourage behavior changes (Lowrey & Marain, 2014). Another problem with youth sports concussion laws is the lack of enforcement, oftentimes due to the absence of defining the governing body, such as public officials or school administration (Lowrey & Marain, 2014).

In 2011, the North Dakota legislative assembly acknowledged the significance of concussion in youth sports by passing a concussion management bill, Senate Bill 2281. The law mandates that both public and non-public schools that sponsor athletic activities design and implement a concussion management program to aid in the detection, evaluation, and treatment of sports-related concussion in North Dakota student athletes. The program mandates that a student athlete be immediately removed from the participating activity if he or she reports or displays and signs or symptoms of concussion and be promptly evaluated by a licensed, registered, or certified health care provider whose scope of practice includes concussion evaluation and management (North Dakota Century Code, Sixty-second Legislative Assembly of North Dakota, 2011; NDHSAA, 2013). The athlete is not allowed to return to practice, training,

or competition until authorized, in writing, by a licensed health care provider. The health care provider's signed authorization acknowledges they are acting within their scope of practice and are trained in the evaluation and management of concussion. The authorization is retained by the school district for seven years after the student is no longer enrolled (NDHSAA, 2013).

Many states have included a liability limitation in their youth sports concussion law to protect schools and/or health care professionals (Harvey, 2013). North Dakota law protects public and nonpublic school districts, officers, employees, and officials from lawsuits filed by athletes or their families. However, according to North Dakota legislature, health care professionals are not immune from civil liability that may arise as a result of an improperly managed concussion resulting in unforeseen morbidity or mortality (Harvey, 2013; North Dakota Century Code, Sixty-second Legislative Assembly of North Dakota, 2011)

Rural Health Considerations

Adolescents in rural health communities are at higher risk for concussion compared to their urban counterparts as a result of high-risk behaviors such as operating farm equipment, ATVs, and automobile accidents due to poor road conditions and/or alcohol consumption (Menjugas-MacDuff, 2015). In North Dakota, teenagers residing in rural communities are on average 3.9% more likely to partake in risk-taking behaviors such as driving or riding in an automobile without a seatbelt or while drinking alcohol and texting or talking on the phone while driving (Centers for Disease Control and Prevention [CDC], Division of Adolescent and School Health [DASH], Youth Risk Behavior Surveillance System, [YRBSS], 2015). While accidents are high amongst rural teenagers, so are sport-related concussions. Football, a high impact sport popular amongst young male athletes in rural communities, accounts for the highest proportion of sport-related concussion of all high school sports (Guerriero, Proctor, Mannix & Meehan III,

2012). There are currently 43 rural football teams/cooperative sponsorships, known as 9-man football, in North Dakota (NDHSAA, 2016).

According to the National Athletic Trainers' Association, only 42% of high schools have access to an athletic trainer who are known to aid in concussion recognition, treatment, and return to play/school recommendations (Pryor et al., 2015). Furthermore, only approximately 9% of athletic trainers are employed by elementary and secondary schools (De Los Angeles Whyte, Benton, & Whyte, 2013). Athletic trainers are most often employed by health care facilities or universities, and are largely unavailable to rural school districts. While it's not uncommon practice for PCPs to manage concussions, make return to play decisions, and return to school recommendations, this is commonly the case for providers practicing in rural communities (Zonfrillo et al., 2012). Rural health care providers must be resourceful and astute at the same time due to limited funding and resources, often diagnosing concussion with clinical judgement skills alone. Rural student athletes who have experienced a concussion are at greater risk for symptom prolongation, recurrence, and complications related to prolonged transportation times and limited health care resources (Menjugas-MacDuff, 2015). Rural practitioners must stay current in evidence-based practice recommendations and protocols to reduce concussion complications (Menjugas-MacDuff, 2015).

Participating Rural Health Clinic, School, and Community Profiles

Linton Hospital and Clinics. The Linton Hospital and Clinics network, also known as Linton Medical Center (LMC), is a federally recognized Critical Access Hospital with 24-hour emergency services, a 14-bed inpatient facility, and has three affiliated clinics: Linton Medical Center and Hazelton Clinic located in south central North Dakota and Campbell County Clinic located in north central South Dakota. The PCPs at Linton Clinics include one physician, three

nurse practitioners, and two physician assistants. The providers also provide emergency department (ED) and hospital coverage at the Linton Hospital. Supporting staff includes five nurses. The clinic provides primary health care to patients of all ages including a variety of general and acute services, including sports physicals. Linton Medial Center offers an on-site laboratory, a full radiology department, and physical and occupational therapy services. Specialty clinic services, such as a pediatrics and orthopedics, are offered either monthly or bi-monthly by visiting physicians. Rural PCPs at Linton Hospital and Clinics see a combined 548 patients per month with an average patient age of 55 (R. Jochim, personal communication, May 18, 2017).

The Linton Medical Center is in Linton, North Dakota. The current population estimate for the community of Linton is 1047 (City-data.com, n.d.). There are currently 116 students enrolled at the local high school, Linton Public School, and there are no athletic trainers employed (Athletic Training Locations and Services [ATLAS], 2017). The Hazelton Clinic is in Hazelton, North Dakota; the current population estimate is 225 (City-data.com, n.d.). Hazelton Public School co-ops with Linton Public School for sports. Linton Clinic also provides rural access health care to surrounding rural communities in Emmons County, North Dakota, including Braddock (estimated population 21), Hague, (estimated population 67), and Strasburg (estimated population 392) (City-data.com, n.d.). Other populated communities in Emmons County for which there is no census data include Hull, Kintyre, Temvik, and Westfield. There are 2.4 individuals per square mile in Emmons County, and 19.9% of the population is under the age of 18. Emmons County is 97.0% Caucasian, and the median household income is $45,472 (United States Census Bureau, 2016).

The Campbell County Clinic is in Herreid, South Dakota. Herreid's current population estimate is 417 (City-data.com, n.d.). The rural communities located in Campbell County, South Dakota served by Linton Clinics include Pollock (estimated population 85; estimated median household income $31,512) and Mound City, South Dakota (estimated population 67; estimated median household income $36,973) (City-data.com, n.d.). There are two individuals per square mile in Campbell County, and 17.0% of the population is under the age of 18. Campbell County is 97.4% Caucasian, and the median household income is $45,800(United States Census Bureau, 2016).

Washburn Family Clinic. Washburn Family Clinic (WFC), located in Washburn, North Dakota, is a remote clinic of Community Memorial Hospital, located in Turtle Lake, North Dakota. Washburn Family Clinic is affiliated with Catholic Health Initiatives (CHI) St. Alexius Health. Community Memorial Hospital is a federally recognized Critical Access Hospital with 24-hour emergency services and a 25-bed medical facility in central North Dakota. The Washburn Family Clinic PCPs are comprised of three nurse practitioners, who also provide ED and hospital coverage at Community Memorial Hospital. Supporting staff includes two nurses and two certified nursing assistants. The Washburn Family Clinic offers a full range of family practice services to patients throughout the lifespan, including sports physicals. The clinic offers complete laboratory, x-ray, and ultrasound services. Physical therapy is also available at the clinic three days a week. Surgical consults are offered monthly by a consulting surgeon from CHI St. Alexius Mid Dakota Clinic. The PCPs at Washburn Family Clinic see a combined 183 patients per month with an average patient age of 48.7 (K. Hanson, personal communication, May 5, 2017).

The current population estimate for the community of Washburn is 1193 (City-data.com, n.d.). There are currently 119 students enrolled at the local high school, Washburn High School, and there is one part-time athletic trainer employed (ATLAS, 2017). The PCPs at the Washburn Family Clinic also provide health care to members of surrounding communities in McLean County, such as Turtle Lake (estimated population 581) and Wilton (estimated population 726) (City-data.com, n.d.). There are currently 77 students enrolled at the local high school, Turtle Lake-Mercer Public School, and there is not an athletic trainer employed (ATLAS, 2017). There are 4.2 individuals per square mile in McLean County, and 21.3% of the population is under the age of 18. McLean County is 90.9% Caucasian, and the median household income is $59,976 (United States Census Bureau, 2016).

Congruence of the Project to the Organization's Strategic Plan/Goals

The rural providers at LMC and WFC identified a need for concussion education and a concussion diagnosis and management toolkit for the rural student athletes. The rural providers identified a lack of consistency and ambiguity amidst current concussion management guidelines as being a key barrier in proper concussion management. Additionally, there is a lack of confidence in making return to play and return to school decisions. A concussion educational session and a concussion toolkit was implemented to assist the rural primary care providers in concussion diagnosis and management.

CHAPTER II. LITERATURE REVIEW

Literature Review and Synthesis

Methods

A literature search to better comprehend concussion assessment, management, guidelines, and education was conducted using four electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Cochrane Database of Systematic Reviews (CDSR), PubMed, and Science Direct Nursing Journals. The search also included the Center for Disease Control (CDC) website. To ensure relevant and current research would be incorporated into the clinical practice, the literature search included studies published from 2012 to current. Keywords that were utilized in the search strategy include the following: "concussion," "mild traumatic brain injury," "concussion protocol," "concussion guidelines," "concussion assessment," "concussion diagnosis," "concussion management," "concussion treatment," "concussion education," "concussion discharge instructions," "return to play guidelines," "return to school guidelines," "sports," "rural," "toolkit," "primary care provider," and "family nurse practitioner." Inclusion criteria included: peer-reviewed research articles, systematic reviews, original research, and clinical practice guidelines relevant to concussion assessment, management, guidelines, and education. Excluded from the literature search was school nursing, speech pathology, military personnel, and non-traumatic brain injuries.

Background

Definition

A concussion is defined as "a traumatically induced transient disturbance of brain function" (Harmon et al., 2013, p. 16) caused by a complex pathophysiological process because of either a direct or jolting impact to the head, face, neck, or body that may cause the brain to

slide against the inner skull wall (Halloran, 2015; McCrory et al., 2017). All concussions are a subset of and referred to as mild traumatic brain injuries (MTBI), but not all MTBIs are concussions. Concussions are considered to be less severe and, oftentimes self-limited, brain injury on the traumatic brain injury spectrum (Harmon et al., 2013).

Pathophysiology

The cause of cellular damage resulting in concussion is due to the rapid acceleration and deceleration forces transmitted to the moving brain. Upon impact, the brain initially lags behind the movement of the skull, then moves towards the direction of impact, striking the inner skull, then returns to original position (Edwards & Bodle, 2014). The force of impact and both linear and/or rotational forces disrupt vascular and neural elements within the brain resulting in a complex cascade of cellular injury as demonstrated by the clinical presentation of a concussion (Edwards & Bodle, 2014; Harmon et al., 2013).

On a cellular level, microscopic axonal dysfunction involves neuronal depolarization, release of excitatory neurotransmitters such as glutamate, ionic shifts, inactivation of sodium and potassium pumps, changes in glucose metabolism, and dissociation of metabolism and cerebral blood flow (Edwards & Bodle, 2014). Anatomically, the deep midbrain, mesencephalon, corpus callosum, and fornix receive the highest impact of strain during impact. The complex cellular injury sustained during a concussion results in a functional disturbance, rather than a structural injury, therefore head imaging such as computed tomography (CT) or magnetic resonance imaging (MRI) is unable to detect abnormalities (McCrory et al., 2017).

A concussive injury requires energy to heal and restore homeostasis within in the brain. Increased energy requirements are complicated by the presence of decreased cerebral blood flow and ongoing mitochondrial dysfunction, resulting in an imbalance between energy supply and

demand (Harmon et al., 2013). Until normal brain function is reestablished, the brain is vulnerable to prolonged dysfunction or worsening symptoms if exposed to subsequent impacts or excessive physical and/or cognitive activity (Harmon et al., 2013).

Concussion Evaluation

Signs and Symptoms

Recognizing the typical signs and symptoms of concussion is paramount to a prompt diagnosis and treatment initiation. Concussion signs and symptoms are variable and may manifest both early and late after a head injury (Edwards & Bodle, 2014). Typically, clinical signs and symptoms may include one or more of the following clinical domains: physical signs, cognitive impairment, emotional changes, and sleep disturbances (Lynch, 2016; McCrory et al., 2017). Physical signs and symptoms often appear early, either immediately or within minutes of head injury, and include retrograde and/or anterograde amnesia, confusion, and occasionally a loss of consciousness. Other physical signs and symptoms, often occurring early in concussion, include headache, dizziness, balance problems, nausea with or without vomiting, numbness/tingling, photophobia, phonophobia, and reports of feeling dazed and/or stunned (Lynch, 2016).

Throughout the next several hours to days following a concussion, the patient may experience a combination of cognitive, emotional, and sleep-related changes. Cognitive signs and symptoms include confusion and forgetfulness about recent events, repeating questions, delayed response, slowed reaction times, difficulty concentrating, mental fogginess, and difficulty learning new material. Emotional signs and symptoms of concussion include irritability, fatigue, emotional lability, anxiety, and depression. Sleep-related signs and symptoms include drowsiness, insomnia, and sleeping more or less than usual (Lynch, 2016). A concussion

should be suspected and the appropriate management initiated if one or more of the above-mentioned signs and symptoms are present (McCrory et al., 2017).

Incidence

Of all sport-related injuries occurring among high school athletics, 13.2% are reported to be concussion (Guerriero, Proctor, Mannix, & Meehan, 2012) with health care visits for sports-related concussion increasing by 60% over the past decade (Edwards & Bodle, 2014; Halloran, 2015). The reason for the dramatic increase in concussion incidence is unknown, but is widely speculated to be a result of the heightened concussion education and awareness leading to better recognition and reporting of concussions, rather than an increase in the number of concussions occurring (Edwards & Bodle, 2014; Harmon et al., 2013). Regardless of the reason for increased incidence, 1.6 to 3.8 million sport-related traumatic brain injuries occur in the US annually, with approximately 2.4-2.5 concussions occurring per 10,000 athletic exposures (Guerriero et al., 2012). The incidence may actually be higher in high-risk sports such as football, hockey, soccer, wrestling, basketball, and lacrosse (De Los Angeles Whyte, Benton, & Whyte, 2013; Guerriero et al., 2012; Harmon et al., 2013). Football accounts for the highest proportion of sports-related concussion, comprising approximately 50% of reported concussions (Guerriero et al., 2012), and the highest rate of concussions per athletic exposure (0.47) (Edwards & Bodle, 2014). The "backs" (quarterbacks, linebackers, and running backs) having a three times higher risk of concussion because of their high-impact position, and kickoffs have a four times higher rate of concussion (Harmon et al., 2013). And while the incidence for concussions are highest in football, the true incidence of all sports-related concussion is likely higher as many athletes fail to report concussion symptoms (Harmon et al., 2013).

Risk Factors

There are two types of risk factors known to affect the risk of sustaining a concussion: primary risk factors that increase concussion probability and secondary risk factors that predispose an athlete to poor recovery outcomes. Becoming aware of concussion risk factors enables the PCP to better detect concussion and determine management decisions (Elbin, Covassin, Gallion & Kontos, 2015). Both well-documented and emerging risk factors include, but are not limited to the following: concussion history, age, sex, sport type and setting, pre-existing migraine history, learning disability, hyperactivity disorders, and post-traumatic migraine (Elbin et al., 2015; Harmon et al., 2013).

A history of concussion increases the risk of sustaining another concussion by 2-5.8 times (Elbin et al., 2015; Yumul & McKinlay, 2016). Specifically, athletes with one, two, three, or more prior concussions are 1.5, 2.8, and 3.4 times more likely to sustain another concussion, respectively (Elbin et al., 2015). Multiple concussions are well-documented to increase recovery time (Yumul & McKinlay, 2016). Younger athletes have a higher concussion incidence rate and a longer recovery time compared to older athletes due to the developing brain being physiologically different (Elbin et al., 2015; Harmon et al., 2013). Incidence rates for sports-related concussion and a longer duration of recovery are higher for females compared to males in sports played by both sexes. The most common mechanism of concussion injury is by player-to-player contact and concussion rates are higher during game competition rather than practice (Harmon et al., 2013). Athletes who develop a post-traumatic migraine, comprising headache, nausea, visual disturbances, light and sound sensitivity, and dizziness, are more likely to experience a prolonged recovery, with symptoms often lasting longer than 21 days (Elbin et al., 2015; Harmon et al., 2013).

Mood, learning, and attention disorders, either preexisting or as a result of a concussion, complicate concussion diagnosis and management. Mood disorders, such as depression and anxiety, do not increase the incidence of concussion. However, when evaluating an athlete for concussion, it is difficult to determine if symptoms preceded, were a result of, or were exacerbated by a concussion (Harmon et al., 2013). Learning disabilities and attention disorders such as attention deficit disorder or attention deficit hyperactivity disorder may be associated with an increased cognitive disability and risk for prolonged recovery after a concussion. Undoubtedly, learning disabilities and attention disorders share common characteristics of concussion, making diagnosis and management more difficult (Harmon et al., 2013). Obtaining a baseline assessment of an athlete's preinjury mood, learning, and attention capacity may be beneficial to PCPs evaluating athletes with a suspected concussion (Elbin et al., 2015; Harmon et al., 2013).

Diagnostic Variability

Diagnosing concussion may be a complicated endeavor, as concussions are a functional brain injury, rather than a structural brain injury, and is not easily identified with radiologic head imaging (Halloran, 2015). Diagnosis is clinical, based on the neurological examination and subjective assessment provided by the athlete, parent, and/or sideline witness (Halloran, 2015; Wandling & Guillamondegui, 2015). State legislatures recommend a student athlete undergo a formal evaluation if a concussion is suspected, and a structured assessment tool may be used to aid in diagnosis. There are a variety of assessment tools designed to be used at the sideline or by health care professionals, though none are definitively diagnostic and few are uniform, resulting in a variation in how concussion is diagnosed amongst health care providers (Halloran, 2015; Wandling & Guillamondegui, 2015).

Concussion Management

Current Practices

Zemek et al. (2014) conducted a study assessing the knowledge of front-line health care providers (family medicine physicians, emergency department providers, pediatricians, nurse practitioners, and physician assistants) in regard to pediatric concussion diagnosis and management. The researchers concluded knowledge amongst providers diagnosing concussion is sufficient, however there appears to be inconsistencies in regard to concussion management, with inadequate use of guideline recommendations for return to play and return to school (Kleinjan, 2015; Zemek et al., 2014). To examine providers' knowledge and current clinical practices, a survey presented three clinical case vignettes on pediatric head injuries, incorporating concussion diagnosis, return to play (same-day return to play, graduated return to play, and cognitive rest), concussion guideline implementation, and barriers to guideline application. Physicians and non-physicians (nurse practitioners, registered nurses, and physician assistants) performed similarly in successfully recognizing pediatric concussions; 90% and 85%, respectively. Furthermore, 87% of both physicians and non-physicians correctly utilized concussion recommendations discouraging same-day return to play. However, both physicians and non-physicians inadequately demonstrated knowledge of concussion guidelines for graduated return to play (37% and 31%, respectively) and failed to recommend cognitive rest (33% and 30%, respectively). There were no statistically significant differences between physician and non-physician groups in concussion diagnosis or return to play management (Zemek et al., 2014).

Seventy percent of providers reported using published concussion guidelines to guide clinical decision making "frequently" or "always." However, only 26% reported "frequently" or "always" using the concussion scoring scales included in the guidelines. Also, only 59%

"frequently" or "always" test balance during concussion assessment as recommended in concussion guidelines. Amongst providers, only 3% reported "never" using published concussion guidelines. The most common barriers to concussion guideline application were a lack of knowledge in the existence of published guidelines or lack of knowledge in the best guideline to use (Zemek et al., 2014).

Lebrun et al. (2013) conducted a cross-sectional study to assess and compare the concussion knowledge base, clinical practices, and concussion continuing medical education (CME) needs of family physicians in two different regions in North America: Alberta, Canada (CAN) and North and South Dakota, United States (US). Family physicians in both groups were found to use practices inconsistent with current published concussion guidelines and recommendations. The authors also found a need for improved education and training for family physicians to improve the management of sports-related concussion (Lebrun et al., 2013).

The study results of family physicians caring for concussions in Canada and US were similar: For example, 96.3% and 94.5% of providers reported diagnosing and treating concussions, respectively. There were, however, a few noteworthy exceptions. Significantly more US family physicians (64.4%) were practicing within rural communities than were Canadian family physicians (27.5%). Only 9.4% of US family physicians reported using the most current Zurich Guidelines to guide concussion management, however, US physicians used computerized neurocognitive testing substantially more than Canadian physicians (19.8% and 1.3%, respectively). In addition, less than half of both US and Canadian family physicians encouraged cognitive rest during concussion education and 11% of physicians from both regions used outdated grading scales when determining return to play recommendations (Lebrun et al., 2013).

Reassuringly, over 90% of physicians in both groups effectively used history and physical examination skills for clinical decision making and recommended physical rest during concussion education. Also, important to note is the majority of respondents (84.0% CAN and 93.8% US) desired further concussion education and planned to take CME credits to do so. The most recognized resource for continuing education on concussion management for both groups of physicians were CME courses, however Canadian physicians also sought concussion education by colleague consultation and websites (31% and 27.5%, respectively) (Lebrun et al., 2013).

Return to Play Recommendations

Return to play refers to returning to any exertional physical activity after sustaining a concussion. Return to play guidelines were developed during the 2nd International Conference on Concussion in Sport held in Prague in 2004 and were most recently updated in 2017. The 5th International Conference on Concussion in Sport held in Berlin in 2016 has the most comprehensive and updated return to play guidelines, consisting of a five-day graduated return to play protocol. They were developed to guide the health care provider's decision-making process, but should not undermine clinical judgement, and may need to be individualized to fit the patient's needs (McCrory et al., 2017).

The patient should never be allowed to return to the sport or activity within the same day of the injury resulting in concussion (McCrory et al., 2017). The 5-day return to play protocol may be initiated when the patient is symptom free without the use of pain medications. In addition, the return to play protocol cannot be initiated until the student athlete has successfully returned to school and is asymptomatic at rest. Each of the 5-step stages requires a minimum of 24 hours to complete, therefore if the patient experiences an uncomplicated concussion, he or she

may return to play in approximately one week. The return to play protocol includes: (1) no activity; (2) light aerobic exercise; (3) sport-specific exercise; (4) noncontact sport-specific exercise; (5) full-contact practice after medical clearance; and (6) return to normal game play. If the athlete develops post-concussion symptoms during any portion of the protocol, the patient should return to the previous asymptomatic level and try to progress again after a further 24-hour period of physical rest (McCrory et al., 2017).

Children younger than age 13 who experience a concussion appear to have a longer recovery after concussion and are at a greater risk for diffuse brain injury compared to older children. Thus, providers should be increasingly cautious when determining return to play recommendations in athletes younger than age 13. A more conservative return to play approach is recommended by extending the duration of asymptomatic rest, time at each stage of the return to play protocol or individualized in concordance with the patient's symptoms (CDC, 2016; McCrory et al., 2017).

Harmon et al. (2013) created a position statement on sport concussions for the American Medical Society for Sports Medicine (AMSSM). AMSSM recommendations for return to play were similar to that of the Concussion in Sport consensus statement. In addition to an individualized and gradual return to play using the 5-day graduated return to play protocol, AMSSM places emphasis on individualizing the return to play recommendations for each specific concussion, with the step-wise progression taking days, to weeks, to possibly, months. The AMSSM also recommends a final return to play determination be made by a licensed health care provider. Medical clearance can be issued upon completion of the 5-day graduated return to play protocol if the athlete is asymptomatic and has a normal neurological exam consisting of a normal cognitive and balance evaluation (Harmon et al., 2013).

A retrospective study conducted by Carson et al. (2014) found 43.5% of concussed athletes prematurely return to activity, resulting in an exacerbation or recurrence of symptoms. Another retrospective study conducted by De Maio et al. (2014), evaluated provider discharge instructions given to school-aged patients in an emergency department following a concussion. Despite meeting diagnostic concussion criteria, 31% lacked a documented discharge diagnosis of "concussion." Furthermore, most patients were discharged home without concussion-specific instructions (62%) despite knowledge of the importance of cognitive and physical rest during concussion recovery. The recommended time period for follow-up, with either their primary care provider or a subspecialty provider, was highly variable. In addition, almost two thirds of discharge instructions lacked recommendations for activity restriction. And, when present, the recommendations were highly variable: no return to play for one, two, or more weeks, until symptoms resolve, or until cleared by your physician. The authors conclude children meeting diagnostic criteria for concussion often lack concussion-specific diagnoses and activity restrictions at discharge. The study demonstrates a need for concussion awareness in all providers to improve adherence to activity restriction and follow-up to improve concussion-related health outcomes (De Maio et al., 2014).

Return to School Recommendations

Making recommendations for returning a student-athlete to the classroom may be challenging task for a provider due to the overall lack of research in the subject and emerging research conflicting with previously adhered to guidelines. According to (previously mentioned) Carson et al. (2014), guidelines have historically recommended cognitive rest until all symptoms resolve. Cognitive rest, although not consistently defined throughout literature, consists of activities that require increased cognitive functioning, such as texting, videogames, television,

and schoolwork. Data suggests increased cognitive activity may result in symptom exacerbation, recurrence, or a delay in recovery. Therefore, limiting scholastic activity or accommodating for student athletes' needs may necessary. The results of the study revealed 44.7% of student athletes prematurely returned to school and experienced a recurrence or worsening of concussion symptoms, even when given the appropriate recommendations by physicians (Carson et al., 2014). Carson et al. (2014) also found the return to school recommendations to be inadequately researched, resulting in recommendations that are vague and not practical for providers.

Eastman and Chang (2015) conducted a comprehensive literature search to assess "the optimal type and amount of cognitive rest for patients with a sports concussion" (p. 236). Of the seven studies meeting inclusion criteria, one met class I criteria and six met class IV criteria. After the review of literature, the authors concluded there is a need for further controlled trials of concussion cognitive rehabilitation; the optimal cognitive load in concussion recovery was inconclusive. Two class IV studies determined an increased cognitive load worsens the student-athlete's concussion symptoms. Wherein, limiting high levels of cognitive functioning, described as more than one hour of combined homework, videogames, and online activity, may be vital for recovery. On the contrary, the most current study and the only with class I evidence, conducted by Thomas, Apps, Hoffmann, McCrea, and Hammeke (2015) found cognitive rest with a stepwise return to school and activity to be necessary during the acute recovery period (days one to two post-injury). Two studies (class I and class IV evidence) found benefit in school attendance in the subacute recovery period (days 3-21 post-injury). After comparison of the literature, the authors of the systematic review recommend one to two days of cognitive rest followed by an individualized graduated return to normal cognitive activity following a concussion (Eastman & Chang, 2015).

As described in the above literature review, Thomas et al. (2015) conducted the first prospective randomized controlled on emergency department pediatric patients diagnosed with a concussion to evaluate if strict rest recommendations improve recovery. The strict rest (intervention) group, who were instructed to be on strict rest for five days at home with no schoolwork, work, physical activity, or social activity followed by a graduated return to school, reported less school attendance on days two to five compared to the usual care (control) group who were instructed to rest for one to two days at home followed by a graduated return to school after symptom resolution (3.8 hours and 6.7 hours at school on days two to five, respectively). The strict rest group reported more daily post-concussion symptoms, and half of the group took three days longer to report symptom resolution compared with the usual care group. The authors suggest the protracted symptoms may be the result of missing social interactions, falling behind academically, and a lack of endorphin-releasing exercise. There was no clinically significant difference in neurocognitive or balance outcomes between the groups. The authors conclude that strict rest for five days at home, offers no benefit over usual care, or one to two days of rest at home followed by a graduated return to school progression (Thomas et al., 2015)

Communicating the student athlete's prescribed academic restrictions or accommodations should be documented in writing and communicated with parents, teachers, and school administrators (Provance, Engelman, Terhune, & Coel, 2016). While there is not a guideline outlining the preferred return to school practices, the goal is to limit academic activity to a level that is tolerable for the student and does not cause a worsening or recurrence of concussive symptoms. Using a gradual, but progressive, return to academic activity has been proven most effective. Students may benefit from attempting homework at home prior to immediately returning to school and attempting school-paced assignments. When the student returns to

school, sitting at the front of the class is recommended to be monitored and assisted by the teacher. In addition, students may need a quiet and dark work environment, frequent rest periods, extra time to complete assignments, and a reduced workload while recovering from a concussion. Postponing testing for one to two weeks is recommended. In general, the student athlete's symptoms should guide academic accommodations, and the provider may help ease the process with maintaining communication about accommodations with his or her teacher(s) (Provance et al., 2016).

Standardized Concussion Assessment Tools

Standardized concussion assessment tools have been created to assist both lay people and health care providers in the recognition and management of concussion. Concussion assessment tools should be used as a diagnostic adjunct and should not replace the clinical judgement of the health care provider in diagnosing a concussion (Harmon et al., 2013). The Concussion in Sport Group (CISG) last convened in 2016 to revise and update the concussion management consensus guideline and an office diagnostic tool, known as the Sport Concussion Assessment Tool (SCAT) (Carson et al., 2014; Harmon et al., 2013). The concussion guideline and assessment tool were developed for use by health care professionals to assist in the delivery of consistent, evidence-based concussion management. The fifth edition of the Sport Concussion Assessment Tool (SCAT5), can be used on athletes aged 13 years and older. The Child SCAT5 is to be used on athletes ages five to twelve with modifications in the language and tests that are appropriate for the patient's younger age (Harmon et al., 2013). Both the SCAT5 and Child SCAT5 can be freely copied in its original form for distribution to health care providers (Echemendia et al., 2017).

The SCAT5 is an eight-page assessment tool that is includes measures and methods proven useful in detecting sports-related concussion. The SCAT 5 is comprised of an immediate or on-field assessment (including red flag signs, observable signs, memory assessment, Glasgow coma scale [GCS], and cervical spine assessment) and an office or off-field assessment used by health care providers. The office assessment is comprised of the athlete's background information (including concussion history and concussion modifier information), symptom evaluation (completed by the patient), cognitive screening (including orientation, immediate and delayed memory, and concentration testing), neurological screening (including a brief neurological exam and balance testing), and a section for scoring the SCAT5 and making the decision to diagnose a concussion. The document has detailed instructions for health care providers, strategies to help guide treatment, and concussion injury advice for the patient and caretaker (Echemendia et al., 2017). Each section is scored individually; cumulative scores are not used in the SCAT5. Individual SCAT5 scores are not solely used for concussion diagnosis or in making decisions about an athlete's readiness to return to activity (Echemendia et al., 2017; Harmon et al., 2013). The complete SCAT5 will take at least, if not more, than 10 minutes to complete (Echemendia et al., 2017).

In 2006, the CDC published a systematic assessment tool, the Acute Concussion Evaluation (ACE), to assist health care providers in concussion assessment and management (Gioia, 2012). The ACE protocol is a two-page document and includes four sections: defining injury characteristics, symptom check list, risk factors for protracted recovery, red flags for emergency management, and a follow-up action plan (CDC, 2006). The injury characteristics section further defines the injury and resultant signs of concussion such as amnesia, loss of consciousness, confusion, and seizure activity. The symptom checklist section assesses for the

presence of post-concussion symptoms in the four symptom areas, physical, cognitive, emotional, and sleep, as reported by the patient and/or parent. The presence of each symptom is assigned one point and a total symptom score greater than "0" indicates the presence of post-concussion symptoms. The symptom checklist also assesses whether there is a worsening of symptoms with physical or cognitive exertion and how different the patient is acting from baseline, measured on a scale of 0-6. The next section of the ACE tool assesses the presence of risk factors that may prolong recovery, including prior concussions, chronic headaches, developmental disabilities, and psychiatric diagnoses. The ACE tool includes "red flag" signs for both the provider and caretaker to monitor for. The ACE protocol concludes with a follow-up action plan (CDC, 2006).

After completing the ACE protocol, the health care provider has a full definition of the concussion and concussion symptoms. ACE does not include a score-guided management plan. Instead, the health care provider is to use the obtained history to proceed with individualized management planning. The CDC published an ACE care plan for returning to school and work that contains general concussion guidance and education which is directed toward the patient and his or her parent/guardian. ACE includes guidance in returning to daily activities, returning to school, returning to sports including gradual return to play guidelines, and a referral plan (CDC, 2006).

Consequences

The prognosis for a complete recovery for an appropriately managed concussion is good with most concussions resolving within 7-10 days. Nonetheless, concussions can go undiagnosed leading to potentially catastrophic events (Gillooly, 2016). Despite proper evaluation and

treatment, complications may ensue. Practitioners must monitor for short, medium, and long-term complications to promote optimize quality of life (Harmon et al., 2013).

Although rare, the most serious possible short-term consequence of premature return to play following a concussion is second impact syndrome (SIS) which causes diffuse cerebral swelling. Second impact syndrome occurs when an athlete sustains a subsequent or repeated head injuries before the symptoms associated with the initial concussion have resolved (Edwards & Bodle, 2014; Harmon et al., 2013). The proposed mechanism behind SIS is that after the initial concussion, the brain loses the ability to autoregulate intracranial and cerebral perfusion pressure (Gillooly, 2016). After sustaining a second head injury, the vulnerable brain undergoes rapid and massive cerebral edema, increased intracranial pressure, brain herniation, and ultimately coma and death within two to five minutes (Edwards & Bodle, 2014; Gillooly, 2016). Second impact syndrome is found to occur more frequently in boxers and athletes younger than 18 years. Although rare, with the exact incidence unknown, the major implication to consider in SIS when making return to play recommendations and a compelling reason to heed to recommendations that athletes refrain from returning to play until concussion symptoms have resolved (Harmon et al., 2013).

The medium-term effects of concussion, also known as post-concussion syndrome, are hard to distinguish from the neurologic and cognitive symptoms that occur during the evolution and resolution of a concussion. Post-concussion syndrome are the signs and symptoms of concussion that persist for weeks to months after the initial head injury. Signs and symptoms are often vague and include any concussion sign or symptom, making diagnosis of the syndrome difficult (Harmon et al., 2013). The most commonly reported symptoms include headache, dizziness, fatigue, sleep disturbance, photophobia, phonophobia, memory impairment, poor

attention and concentration, anxiety, irritability, and depression (Edwards & Bodle, 2014), likely resulting in a decreased quality of life and school performance (Gillooly, 2016). Fortunately, sports-related concussions appear to be less likely to result in post-concussion syndrome than other forms of concussion (Harmon et al., 2013).

Currently, little is known about the long-term consequences of concussions in young athletes. However, potential long-term complications of repeated concussions have been highly publicized in recent years with increasing reports of dementia and parkinsonism occurring in National Football League (NFL) players who have a history of multiple concussions (Lynch, 2016). Accumulative concussions in adults have been thought to cause chronic traumatic encephalopathy (CTE), a neurodegenerative process associated with repetitive brain trauma and is characterized pathologically by the accumulation of an abnormal tau protein in specific parts of the brain (Lynch, 2016; Wandling & Guillamondegui, 2015). Diagnosis of CTE is made solely after death with confirmatory histopathology (Harmon et al., 2013), and the incidence remains unknown (McCrory et al., 2017). Chronic traumatic encephalopathy results in early onset cognitive impairment and neuropsychological disturbances with the following associated symptoms: difficulty in memory and cognition, depression, suicidality, poor impulse control, aggressiveness, parkinsonism, and dementia (Edwards & Bodle, 2014; Harmon et al., 2013). Chronic traumatic encephalopathy is not a continuation of post-concussion symptoms or a symptom of an acute concussion, but rather, is thought to be a rare, but potential, complication of accumulative head trauma that develops decades after exposure (Harmon et al., 2013; Lynch, 2016).

Concussion Prevention

Knowledge Transfer

Sports concussion has been increasingly scrutinized by health care providers, coaches, players, parents, and mainstream media in recent years, yet there remains a limited or a lack of standardized knowledge of concussion recognition and management (Ahmed & Hall, 2017; Provvidenza et al., 2013). The CISG consensus statement identified "knowledge transfer" (KT), or the exchange and application of evidence-based concussion research, as a key process in enhancing awareness of and optimizing education regarding concussion (McCrory et al., 2017). The CISG suggests health organizations may implement a KT model to optimize concussion education by assessing gaps in knowledge and by developing and evaluating education strategies. Based on the results of the outcomes, concussion education may be used during the decision-making process by health care providers. To most effectively enhance knowledge and awareness, it is prudent to identify the needs and learning styles of the target audience, "coupled with evaluation" (McCrory et al., 2017, p. 8).

Primary care providers have a role in enhancing concussion awareness and education in healthy and concussed athletes and their parents in the office (Chinn & Porter, 2016; Provvidenza et al., 2013). Dissemination of concussion education during the preparticipation physical examination is an opportunity for the provider to facilitate concussion reporting and early diagnosis. Chinn and Porter (2016) found despite having concussion education, athletes oftentimes are not cognizant of concussion symptoms at the time of impact due to the adrenaline experienced during athletic competition. Self-assessment, signaling that a concussion has occurred (tapping the top of the head or helmet), and reporting concern to coaching staff with a previously agreed upon phrase ("I think I need to be checked out") should be encouraged during

concussion education (Chinn & Porter, 2016). Emphasis should also be placed on the potential life-altering effects of ignoring concussion symptoms, putting to rest terms used commonly in the media, such as “mild concussion” or “slight concussion” (Ahmed & Hall, 2017; Chinn & Porter, 2016).

CHAPTER III. THEORETICAL FRAMEWORK

The Iowa Model of Evidence-Based Practice

The theoretical model used to guide the implementation of this practice improvement project is the Iowa Model of Evidence-Based Practice to Promote Quality Care (see Appendix A). The Iowa Model provides step-by-step guidance in implementing an evidence-based intervention to make changes and improve primary care practice (Iowa Model Collaborative, 2017; White & Spruce, 2015).

The first step of the Iowa Model of Evidence-Based Practice is selecting a topic, or problem-focused or knowledge-focused "triggers," that arise from providers seeking opportunities for practice improvement or questioning current practice standards amid emerging research or the newest national guidelines (Melnyck & Fineout-Overholt, 2015). After a problem is deemed a priority for the organization, the next step is to form a team responsible for assessing the problem through research, then, if needed, developing recommendations for practice to pilot the change (White & Spruce, 2015). A pilot change of practice is then implemented and evaluated for outcome improvement and the implementation process or practice protocol is modified if necessary. Finally, if the practice changes have been determined to be appropriate for the practice and improve health outcomes, the practice change is adopted by into practice, continually evaluated, and the results are disseminated (Melnyck & Finout-Overholt, 2015).

Topic Selection

The first step in the Iowa Model is to select a topic, which in this PIP, was identified through a clinical problem (Melnyck & Finout-Overholt, 2015). Primary care providers vocalized uncertainty in the proper management of student athlete experiencing concussion in the clinic setting resulted in the topic selection, or problem-focused trigger. Improved awareness

of concussions, in addition to all 50 states passing laws mandating a formal medical evaluation of a student athlete suspected of experiencing a concussion prior to returning to play, has increased concussion prevalence (Edwards & Bodle, 2014; Harmon et al., 2013). Depending on the state, the medical evaluation may be completed by licensed primary care providers, emergency department providers, physical therapists, or athletic trainers. However, in rural communities, PCPs, such as family nurse practitioners, are oftentimes the only available health care provider. Diagnosing and managing concussion can be challenging for rural PCPs, as they lack standard diagnostic tools and resources and may lack adequate experience and proper training in concussion management (Flaherty et al., 2016; Menjugas-MacDuff, 2015). Educating rural health care providers and developing and implementing a toolkit for concussion diagnosis and management will likely complement their practice.

Organization Priority

The optimal growth, development, and safety of pediatric patients in rural North Dakota is deemed a priority for the PCPs practicing at the participating rural health clinics, Linton Clinics and Washburn Family Clinic. Personal discussions with multiple PCPs at the participating rural health clinics determined that additional concussion education and a concussion toolkit would be beneficial to their current practice. Both clinics strive to continually adapt to meet the needs of the community for which they serve and recognize that education is an integral part of developing skills and improving health care (Community Memorial Hospital, n.d.; Linton Hospital, 2017). For that reason, the rural PCPs at Linton Hospital and Clinics and Washburn Family Clinic support the implementation of a concussion toolkit in effort to improve the recognition and management of rural student athletes with concussion.

Team Assembly

The next step in the in the Iowa Model is to form a team. A team of six individuals were assembled to assist the coinvestigator in the development, implementation, and evaluation of the practice change (Melnyck & Finout-Overholt, 2015). The team is composed of five stakeholders: a doctor of nursing practice (DNP/FNP) graduate student (the coinvestigator), a family nurse practitioner (FNP) graduate school faculty member, Dean Gross (the committee chair), a DNP/FNP graduate school faculty member with an interest in the proposed project, Tina Lundeen, a FNP practicing at Washburn Family Clinic, Amy Gotvaslee, and a graduate school appointed faculty member, Shannon David.

The role of the coinvestigator was to develop a project proposal, including a literature review and synthesis of relevant evidence, design the project implementation and evaluation, determine the risk to subjects, and collaborate with committee members. After the project proposal was approved and IRB approval was obtained, the coinvestigator implemented the practice improvement project. After project implementation, the coinvestigator evaluated the project and completed an updated review of literature on concussion diagnosis and management. The role of the graduate faculty members included advising and guiding the coinvestigator during the development and implementation of the practice improvement project. The FNP aided in the development and implementation of the project in the rural clinic setting, as well as dissemination of the project to her colleagues. The role of the graduate appointed faculty member, Shannon David, was to help assist the coinvestigator in the transfer of concussion knowledge and how to best evaluate the knowledge acquisition.

Research and Related Literature Assembly and Critique

A literature review including relevant evidence-based research and clinical practice guidelines, including current practice, return to play recommendations, return to school recommendations, knowledge transfer, and standardized concussion assessment tools was conducted and previously discussed (in the Review of Literature). It was determined that there were sufficient existing clinical practice guidelines and relevant research on the topic of concussion diagnosis and management. The literature review demonstrated that a gap exists in the PCP's knowledge and utilization of clinical practice guidelines for concussion management of student athletes (Lebrun et al., 2013; Zemek et al., 2014). Thus, there was a need for improved concussion knowledge and decision-making resources for primary care providers. The ability to appropriately manage concussions is of vital importance for the rural primary care provider, who is often the sole health care provider available in rural communities (Menjugas-MacDuff, 2015).

Piloting a Practice Change

The next step in the Iowa Model of Evidence-Based Practice was to pilot a change in practice. Piloting, or trialing, the practice improvement project prior to organization implementation will help identify problems that may arise. Piloting involves several steps when planning both implementation and evaluation (Melnyck & Finout-Overholt, 2015).

Selecting outcomes to be achieved. The research evidence, clinical practice guidelines, and the purpose of the project helped provide direction for selecting outcome indicators. The project outcomes will be discussed in detail in a later section.

Collecting baseline data. Baseline data was not indicated, as the participating PCPs have voiced a desire for enhanced knowledge and management tools to aid in concussion diagnosis,

management, return to play guidelines, and return to school recommendations based on prior uncertainty and lack of available resources in decision-making.

Choose an EBP concussion guideline to implement and to guide development of a navigation algorithm for the toolkit. The concussion toolkit was based on evidence and tools from both the Fifth International Conference on Concussion in Sport Group held in Berlin in 2016 and the CDC's Heads Up: Concussion in Your Practice. The CISG authors are an international panel of concussion management experts, and they have also created the SCAT5 concussion assessment tool. Through the research and literature review conducted by the coinvestigator, many studies and concussion management informational articles often referred to the CISG consensus statement, providing evidence that it is a valid concussion guideline for health care providers to abide by. The guideline and SCAT5 were created for health care providers who are involved in the care of injured athletes. Furthermore, a practicing rural FNP on the coinvestigator's dissertation committee found the CISG Consensus Statement guideline and SCAT5 applicable to current rural health clinic practices.

The CDC is a federally operated agency that utilizes quality scientific data to respond to emerging health threats causing death and disability in Americans (CDC, 2014). Thus, the CDC has taken the initiative to educate and provide resources for parents, coaches, teachers, and health care provider to better recognize and treat concussions in youth athletes. The coinvestigator created an algorithm to assist the PCP with the concussion toolkit navigation, and ultimately, evaluation and management of concussions, based on the CISG consensus statement guidelines, SCAT5, and the CDC's ACE care plan (see Appendix B).

Implement PIP on DNP/FNP students. The practice improvement project was piloted on a DNP/FNP graduate cohort. Pilot implementation included the concussion educational

session, presentation of the toolkit and algorithm for its navigation which aids in the diagnosis and management of concussion in the primary care setting, and a guided case study presented by the coinvestigator. The student DNP/FNP used the acquired knowledge and concussion toolkit to provide care for a fictitious patient.

Evaluate and modify outcomes and concussion toolkit. After pilot implementation, the implementation process and outcome indicators were evaluated (Melnyck & Finout-Overholt, 2015). The concussion toolkit was evaluated during the pilot practice change by (a) the completion of a self-confidence evaluation survey to identify concussion knowledge and confidence and (b) personal interviews discussing the effectiveness and usability of the concussion toolkit algorithm. The project's implementation process and concussion toolkit were not found to need modifications after consideration of the evaluation and the personal interview.

Implementation Strategies

To support the implementation of the concussion toolkit, a culture of evidence-based practices had to be embraced by the participating primary care providers. To cultivate a desire for best practice and support practice improvement project progression, it was important to frequently communicate with the primary care provider contact and clinic manager at each clinic (White & Spruce, 2015). Communication created acceptance and an eagerness to implement the concussion toolkit. Strategies to promote implementation of the PIP, provided by the Iowa Model's Implementation Strategies for Evidence-Based Practice (see Appendix C), include: (1) creating awareness and interest; (2) building knowledge and commitment; (3) promoting action and adoption; and (4) pursuing integration and sustained use (Cullen & Adams, 2012; White & Spruce, 2015).

Creating awareness and interest. The task of creating interest in rural concussion management had previously been accomplished through personal conversations with the rural PCPs at the participating clinics. In addition, introducing the concussion toolkit with the rural PCPs and nurses within their organization created awareness of concussions which may enhance the probability of its use in practice. The coinvestigator presented the concussion toolkit at staff meetings at both rural clinics (White & Spruce, 2015).

Building knowledge and commitment. In addition to concussion toolkit implementation in the clinic setting, there was an interactive concussion educational session. The coinvestigator discussed state concussion laws and the current evidence backing the use of the concussion toolkit and SCAT5 (White & Spruce, 2015).

Promoting action and adoption. Demonstrating the usability and workflow of the concussion toolkit in the educational session and allowing the providers to practice using the concussion toolkit was the primary strategy to promote adoption of the concussion toolkit in practice. The providers and supporting staff were encouraged to examine the contents of the toolkit and use it after the presentation during a return skill demonstration (explained in detail in Methods). Input for modifications by each clinic was invited during implementation enhance stakeholder commitment. Potential barriers for concussion toolkit utilization in the practice was encouraged to be communicated with the coinvestigator (White & Spruce, 2015).

Pursuing integration and sustained use. To promote long-term use of evidence-based practice when diagnosing and managing concussions, each clinic was given a concussion toolkit and information to be able to access the SCAT5 online at any location in the future (White & Spruce, 2015).

Project Evaluation and Dissemination of Results

The project outcome indicators, and the overall practice improvement project, was evaluated in two ways. First, as reported by PCPs, an accurate diagnosis and management of a student athlete with concussion will meet the objectives to improve the rural primary care provider's ability to promptly and accurately identify concussion and initiate treatment measures and ability to educate and develop a concussion management plan. Secondly, rural PCPs completed a survey to determine the toolkit's perceived efficacy and the likelihood PCPs will use the evidence-based guidelines and algorithms in practice. The final step of the Iowa Model of Evidence-Based Practice is to disseminate the results of the practice change. Following the completion of the project, the coinvestigator will present a poster presentation on the PIP at the NDSU Nursing at Sanford Health Bismarck Research Day on May 2, 2018. In addition a "question and answer" column related to concussion recognition and evaluation will be sent to the Emmons County Record prior to 2018 fall sport season to enhance concussion awareness. The Emmons County Record is the local newspaper for residents of Emmons County, where the co-investigator will be living and working as a family nurse practitioner at Linton Hospital and Clinics.

CHAPTER IV. PROJECT DESCRIPTION

Project Objectives

1. Improve access to and use of published concussion EBP guidelines for concussion evaluation and management in the rural primary care setting through an educational session and implementation of a concussion toolkit.
2. Enhance the rural PCP's knowledge and confidence in evaluating and managing pediatric concussions in the primary care setting by implementing a concussion educational session, providing a concussion toolkit, and allowing PCPs to evaluate and treat a mock-concussion patient.
3. Provide an opportunity for PCPs at rural clinics to apply knowledge and use their acquired skills to evaluate and manage a sports-related concussion through a return skill demonstration on a mock-concussion patient.

Project Design

Setting and Participants

The PIP setting and participants were chosen by a convenience sample method after completing clinical rotations with many of the rural PCPs at each clinic site. The PIP was conducted at two rural clinics, Linton Medical Center (LMC) and Washburn Family Clinic (WFC), in central North Dakota. At LMC, three FNPs and one PA participated in the educational session, and two FNPs and one PA completed the evaluation portion of the PIP. Supporting staff at LMC that attended the educational session, but were not included in the evaluation process, include three nurses and four paramedics/EMTs. At WFC, three NPs participated in the educational session, and two NPs completed the evaluation portion of the PIP. Supporting staff at WFC that attended the educational session, but were not included in the evaluation process,

included two nurses, a certified medical assistant, a certified nursing assistant, and an administrative assistant. The completion rate of both the intervention and evaluation was 71% (n=5).

Resources

The PIP began with the development of a concussion educational session using PowerPoint (see Appendix D) and a concussion toolkit navigational tool (see Appendix C). After the tools were developed, they were distributed to the coinvestigator's dissertation committee, three emergency department physicians, and the head athletic trainer/program director of athletic training at a local university to be reviewed for validity and accuracy of the content. After the tools were found to be accurate and based on current evidence-based practices, two concussion toolkits were assembled, which consisted of concussion evaluation and management clinical resources. Specifically, each concussion toolkit was comprised of multiple navigational tools, SCAT5s, Child SCAT5s, CISG concussion consensus guidelines, the coinvestigator's concussion educational PowerPoint presentation, and discharge instructions for the patient, parent, coach, and teacher. A release of information was requested by providers at LMC and was added to their concussion toolkit. The estimated cost of each toolkit was approximately 15 dollars.

The mock-concussion patient, a DNP student, was provided the written case study for the return skill demonstration (see appendix H) and a SCAT5 with the symptom severity score already completed and was asked to memorize the chief complaint, history of present illness, and signs and symptoms. The mock-concussion patient was asked to make a few mistakes during each SCAT5 physical assessment to ensure providers could perform the tests and score the SCAT5 when evaluating a symptomatic patient.

An intangible resource included the rural primary care providers' time and willingness to participate in the concussion educational session and subsequent return skill demonstration. As previously delineated in the Iowa Model's Implementation Guide, fostering a culture of EBP practice within the rural health clinic assisted in the implementation and sustainability of the practice improvement project, promoting provider interest and commitment.

Project Implementation

Implementation of the PIP occurred on August 30th, 2017 at LMC and September 6th, 2017 at WFC. The coinvestigator, mock-concussion patient, rural PCPs, and multiple support staff met in conference rooms at each clinic. Prior to the concussion presentation, the participating providers completed a demographics, concussion practices, and concussion education survey (see Appendix E). Then, the coinvestigator presented the concussion educational session and the concussion toolkit was distributed. During the educational session, the coinvestigator demonstrated use of the concussion toolkit and SCAT5 on a mock-concussion patient, a volunteer DNP/FNP student. After the educational session, the PCPs individually evaluated and managed care for the mock-concussion patient using the concussion toolkit and SCAT5 in a clinic room (see Appendix F). Demonstration of the SCAT5 included conducting a history and physical on the mock-concussion patient and using the concussion toolkit to educate and discuss the treatment and plan with the patient. PCPs were encouraged to complete the examination with the sole use of the concussion toolkit, but at any time, could ask for guidance or engage in discussion with the coinvestigator to augment learning. Following the conclusion of both the educational session and return skill demonstration, each PCP completed a self-confidence evaluation survey (see Appendix G). The concussion toolkit and the coinvestigator's assistance in concussion management or workflow problem solving were available to the

providers, if needed, during the 2017 high school fall sport season. The approximate time commitment required by each PCP was 25 minutes for the educational session and 15-30 minutes for the return skill demonstration.

Evaluation Methods

Evaluation of the project involved assessing whether objectives were met. Evaluation of the educational session was measured through a self-confidence evaluation survey and demonstrated during the return skill demonstration of the toolkit. Both the self-confidence evaluation survey (see Appendix G) and case study for the return skill demonstration (see Appendix H) were developed by the coinvestigator. A pre-test was also distributed to identify PCP characteristics, perceived barriers to following EBP guidelines when treating concussions, and current practices (see Appendix E). To guide evaluation of the PIP, a logic model was also developed (see Figure 2).

Objective One

Objective one, to improve access to and use of published EBP guidelines, was evaluated through a 4-point Likert scale statement on the self-confidence evaluation survey: "I will likely use the concussion toolkit, SCAT5, or published concussion guidelines during my next encounter with a pediatric patient presenting with a suspected concussion."

Objective Two

To evaluate objective two, to enhance knowledge and confidence in concussion evaluation and management, a self-confidence evaluation survey was administered after project implementation. The survey included 13 Likert scale statements which assessed the respondents' perceived ability to effectively evaluate and manage concussions in the primary care setting.

Objective Three

The PCPs were evaluated on their ability to demonstrate their acquired concussion evaluation and management knowledge and skills through a return skill demonstration of the concussion toolkit on a mock-concussion patient to address objective three, to successfully evaluate and treat a concussion patient. Providers were evaluated on their ability to assess, diagnose, and treat a mock-concussion patient with a suspected concussion. Evaluation was accomplished by reviewing the video-recorded return skill demonstration. Common themes were noted, and a written narrative described how the providers evaluated and treated the mock-concussion patient.

Data Collection and Analysis

Data collection methods for the PIP included both quantitative and qualitative data collections. The quantitative data collection method involved PCP self-report via the self-confidence evaluation survey. During data analysis of the survey, simple statistical tests (mean scores) were used to analyze the self-confidence evaluation survey. The qualitative data collection method involved direct observation of the return skill demonstration by the coinvestigator. The co-investigator conducted the on-site return skill demonstration and reviewed the demonstrations via video recording. During data analysis of the direct observation of the return skill demonstration, modes and themes were determined and a written narrative was inferred.

Protection of Human Subjects

To ensure the protection of the rights and safety of the human subjects taking part in the author's practice improvement project, North Dakota State University Institutional Review Board (IRB) approval was obtained prior to PIP implementation. Neither patient contact nor

chart review were required for project implementation or data collection, posing minimal to no risk to patients. The PIP was granted exempt status through the NDSU IRB #PH17271 (see Appendix J). The rural PCPs who chose to participate in the PIP were asked to sign an informed consent notifying them of the potential risks and benefits of the project (see Appendix K). The process of data collection was obtained from the rural PCP's background survey, self-confidence evaluation survey, and return skill demonstration. Providers were informed that participant identifiers were removed during data entry, evaluation, and project dissemination. After reading the potential risks and benefits of the PIP, each participating PCP signed the informed consent.

CHAPTER V. RESULTS[1]

The PIP was evaluated after project implementation to measure outcome attainment. Both quantitative and qualitative data were analyzed to determine the results of the EBP initiative. The following section includes participant demographics, current concussion practices amongst the participants, and project results which are displayed related to the objective they address.

Participant Demographics and Current Concussion Practices

Of the five rural PCPs that participated in the PIP, four identified themselves as FNPs (80%) and one as a PA (20%). Two providers had been in practice for zero to two years (40%), one provider had been in practice for three to six years (20%), one provider had been in practice for seven to 15 years (20%), and one provider had been in practice for 16 or more years (20%). All participants were female (100%). Four providers practiced in both a rural health clinic and a critical access emergency department (80%). One provider practiced in only a rural health clinic (20%). Table 1 illustrates sample demographics.

[1] The material in this chapter was co-authored by Josie Senger and Dr. Dean Gross. Josie Senger had primary responsibility for collecting data at the clinic sites. Josie Senger was the primary developer of the conclusions that are advanced here. Josie Senger also drafted and revised all versions of this chapter. Dr. Dean Gross served as proofreader and checked the math in the statistical analysis conducted by Josie Senger.

Table 1

Sample demographics

Question	Response (N = 5)	Mean (%)
Profession		
Nurse Practitioner	4	80%
Physician	0	0
Physician Assistant	1	20%
Years in Practice		
0-2	2	40%
3-6	1	20%
7-15	1	20%
16 or more	1	20%
Gender		
Female	5	100%
Male	0	0
Practice Area		
Rural health clinic	1	20%
Critical access ED	0	0
Both rural health clinic and critical access ED	4	80%

The providers were asked about their current practices and education regarding concussions. All participating providers diagnosed and/or treated a concussion patient under the age of 18 (100%) within the past year. Three of those providers diagnosed and/or treated one to two patients (60%) within the past year, and two providers diagnosed and/or treated three to four patients (40%). Four providers had seen concussion patients in the emergency department (57%), and three had seen concussion patients in the rural health clinic (43%). Three of the five providers indicated they used EBP guidelines to aid in the diagnosis and/or management of concussed patients (60%), while two providers indicated they did not use EBP guidelines when diagnosing or treating concussions (40%) within the past year. All were asked to provide the resource or EBP guideline they used when evaluating and managing concussions; of the three providers who indicated they used EBP guidelines, only one provider specified that he or she

used “Up-To-Date” as the resource. Providers were asked to identify barriers to using EBP guidelines when evaluating and managing concussions in the rural setting. Providers were allowed to choose more than one barrier for this question with a total of 8 responses recorded. All five providers indicated they had a lack of awareness of existing published EBP guidelines (63%). In addition to a lack of awareness, providers also indicated existing published guidelines are not user friendly and confusing (13%) and there is a lack the time necessary to use EBP guidelines (13%). One provider also reported he or she relies on previous clinical experience to evaluate and manage concussions (13%). Of the five providers, only one provider learned how to assess, diagnose, and manage concussions during graduate education (20%). Two providers had completed additional training or education for the assessment, diagnosis, and/or management of concussions (40%). One provider completed a “CEU” and one provider completed “one week of training at Walter Reed Medical Center prior to an oversea military deployment.” Table 2 illustrates the Providers’ concussion practices and concussion education.

Table 2

Participant concussion practices and concussion education

Question	Answer/Response (N = 5)	Mean (%)
Patients under the age of 18 PCP diagnosed or treated for a concussion within the past year		
0	0	0
1-2	3	60%
3-4	2	40%
5 or more	0	0
Setting in which PCP evaluated or managed concussion patient		
Rural health clinic only	1	20%
Critical access ED only	2	40%
Rural health clinic and critical access ED	2	40%
PCP use of EBP guidelines to aid in evaluation or management of concussions		
Used EBP guidelines	3	60%
Did not use EBP guidelines	2	40%
Perceived barriers to EBP guidelines use[a]	(R = 8)	
Lack of awareness of existing published guidelines	5	63%
Inability to access existing published guidelines	0	0
Published guidelines are not user friendly/confusing	1	13%
Lack of time	1	13%
Previous clinical experience is used to diagnose and manage concussions	1	13%
No barriers identified	0	0
Concussion education during graduate degree		
Yes	1	20%
No	4	80%
Additional training/education for concussions in current position		
Yes	2	40%
No	3	60%

[a]Respondents could choose more than one answer which is reflected in 8 responses (R = 8).

Objective One: Question 14 of Self-Confidence Evaluation Survey

Question 14 in the self-confidence evaluation survey, a Likert scale question, addressed objective one, which was to improve access to and use of EBP guidelines when evaluating and

treating concussions. All five providers responded they “strongly agree” (100%) with the statement “I will likely use the concussion toolkit, SCAT5, or published concussion guidelines during my next encounter with a pediatric patient presenting with a suspected concussion.” These findings are illustrated in Table 3. In addition, the participating rural health clinics have access to a tangible concussion toolkit containing concussion evaluation and management algorithms and guidelines, SCAT5 and Child SCAT5, a graduated return to play protocol, and educational and instructional materials for patients, parents, coaches, and school administrators. They were also provided on-line resources for concussion management guidelines and educational materials.

Objective Two: Self-Confidence Evaluation Survey

Following the educational session and return skill demonstration, providers were provided a self-confidence evaluation survey, a Likert scale survey, to determine their perceived learning and subsequent confidence in concussion evaluation and management, which addressed outcome two. Table 4 illustrates the results of the self-confidence evaluation survey. Most notably, providers felt confident in completing a physical assessment specific to a patient with a suspected concussion, recommending physical rest and guiding a safe return to sports, avoiding medical clearance in the presence of symptoms, recognizing g prolonged symptoms, and making the proper referrals. All five providers “strongly agreed” (100%) with the following six statements: 1) “I am confident in my ability to complete a physical assessment specific to a patient with a suspected concussion,” 2) “I am confident in recommending physical rest and guiding a safe return to sports,” 3) “I am aware patients should not return to sports in the presence of symptoms, and I am confident I will not provide medical clearance to return to sports in the presence of concussion symptoms,” 4) “I am confident in recommending a follow-up

evaluation at the initial office visit," 5) "I am confident in my ability to recognize worsening or prolonged concussion symptoms," and 6) "I am confident in my ability to make the proper referrals for worsening or prolonged concussion symptoms."

Table 3

Self-confidence evaluation survey, questions 1-13

Statement **"I am confident in . . ."**	Strongly Agree	Somewhat Agree	Somewhat Disagree	Strongly Disagree
Recognizing danger ("RED FLAG") signs and symptoms and initiate emergency management	4 (80%)	1 (20%)	0	0
Obtaining a history specific to a patient with a suspected concussion	4 (80%)	1 (20%)	0	0
Completing a physical assessment specific to a patient with a suspected concussion	5 (100%)	0	0	0
Diagnosing a sports-related concussion	4 (80%)	1 (20%)	0	0
Counseling patients and parents about concussions and general concussion management strategies	3 (60%)	2 (40%)	0	0
Recommending cognitive rest and guiding a safe return to school	4 (80%)	1 (20%)	0	0
Recommending physical rest and guiding a safe return to sports	5 (100%)	0	0	0
My awareness of the North Dakota Concussion Law	2 (40%)	3 (60%)	0	0
Acting within my scope of practice; I am trained in the evaluation and management of concussion when providing medical clearance to rural student athletes	4 (80%)	1 (20%)	0	0
I will not provide medical clearance to return to sports in the presence of concussion symptoms	5 (100%)	0	0	0
Recommending a follow-up evaluation at the initial office visit	5 (100%)	0	0	0
Recognizing worsening or prolonged concussion symptoms	5 (100%)	0	0	0
Referring to a specialty for worsening or prolonged concussion symptoms	5 (100%)	0	0	0
Total responses	55 (85%)	10 (15%)	0	0

Objective Three: Return Skill Demonstration

The providers were asked to practice using the concussion toolkit and SCAT5 during a return skill demonstration (see Appendix K) to further enhance provider confidence and demonstrate competence. The goal of the return skill demonstration was to provide the rural providers with an opportunity to practice using the concussion toolkit, SCAT5, and resources to become competent in evidence-based evaluation and management of concussions. The PCPs could perform the return skill demonstration in a way that best benefited their learning style through either an oral case study with prompted assessment skills demonstration or by treating it as an actual patient encounter with the coinvestigator present to answer questions and guide learning. The length of time it took for the providers to complete the return skill demonstration ranged from 13 minutes to 27 minutes.

The return skill demonstration began with a scenario that involved the mock-concussion patient hitting heads with a teammate during volleyball practice which resulted in the patient's chief complaint: "Headache" (see Appendix E). The provider was asked if a concussion is suspected based on the symptom and mechanism of injury, and if he or she would like to evaluate and treat the patient with the assistance of the concussion toolkit and SCAT5. All five providers (100%) recognized the concussion symptom and chose to use EBP when evaluating and treating the mock-concussion patient by answering "yes" to both questions. The PCPs were given the option to review the history portion of the SCAT5, which is comprised of the athlete's background and symptom evaluation as completed by their office nurse (the coinvestigator), or to obtain the history portion of the SCAT5 themselves. Three providers completed the patient's history using the SCAT5 (60%); two chose to review a SCAT5 that had been completed by their intake nurse (40%). While reviewing the athlete's background, four providers (80%) recognized

the patient's risk factor for having a prolonged recovery: a prior history of a diagnosed concussion. One provider (20%) did not initially recognize this risk factor but was recapped about the risk factors for symptom prolongation by the coinvestigator.

All five providers used the SCAT5 as a guide to perform a physical assessment on the mock-concussion patient (100%). The physical assessment domains included in the SCAT5 that were each performed by all five of the providers included: Cognitive screening comprised of orientation questions and immediate memory testing, concentration testing comprised of the digits backwards test and months in reverse order test, a focused neurological screening comprised of five neurological assessments, a balance examination, and delayed recall. Common themes noted throughout the use of the SCAT5 were questions and clarifications about performing and scoring the SCAT5 tests. It was noted that providers most frequently asked questions about performing the "digits backwards" concentration test (80%) and the balance examination (80%). All providers (100%) asked questions about scoring the balance examination and when compiling the scores of each domain during the decision portion of the SCAT5.

Another common theme noted was the level of difficulty of many of the SCAT5 tests, especially when using the assessment tool for children under the age of 12. The providers were using the SCAT5, rather than the Child SCAT5, on the 17-year-old mock-concussion patient. To remedy the provider's feelings of difficulty in using the EBP assessment tool on children younger than age 12, differences between the Child SCAT5 and SCAT5 tests were discussed. Specifically, both the parent and child reports the child's symptoms, the Months in Reverse Order test is changed to Days in Reverse Order test, a Child Version of the Standardized Assessment of Concussion is used, and if the child cannot read, he or she describes what they see in a picture, instead (McCrory et al., 2017). Many providers had forgotten there was a different

form to be used during evaluation and management of a child younger than 12-years-old in the concussion toolkit. Knowledge of the differences between the Child SCAT5 and SCAT5 appeared to alleviate the fear of using the EBP assessment tool on athletes ages 5-12.

To address the perceived level of difficulty of the SCAT5 as stated by the providers, it was discussed that literature suggested that some of the tests, specifically the Immediate Memory test, had a notable celling effect when a 5-word list was used instead of a 10-word list. In other words, simpler tests were found to be an inadequate in evaluating concussion indicators, especially if the patient is exceptionally intelligent or has completed the SCAT5 multiple times. Therefore, the tests have an upper limit (ceiling effect) that are designed for patients to achieve the highest attainable score. It was discussed with providers that the SCAT5 tests, although perceived to be difficult by some, are specific to concussion evaluation and does not require a minimum or maximum score to make a concussion diagnosis (McCrory et al., 2017).

After using the SCAT5 to evaluate the patient and scoring the assessment domains, all of the providers accurately diagnosed the patient with a concussion (100%). Another theme noted during the decision process was questioning if the SCAT5 could be used to diagnose a concussion. As indicated, concussion diagnosis was reviewed as well as the key point that SCAT5 scores should not be used as a stand-alone method to diagnose a concussion or make decisions about readiness to return to competition after concussion (McCrory et al., 2017).

The providers differed in how they created a plan of care and provided patient education, but all verbalized the importance of physical and cognitive rest initially, following a gradual return to play protocol, and close follow-up in one week. One provider (20%) performed patient education and discussed the plan of care with the mock-clinic patient, verbalized the plan of care and key points of patient education with the coinvestigator, and referred to the concussion toolkit

education materials. Two providers (40%) performed patient education and discussed the plan of care with the mock-clinic patient and verbalized the plan of care and key points of patient education with the coinvestigator. One provider (20%) verbalized to the coinvestigator key points of patient education, their plan of care, and referred to the concussion toolkit to distribute educational materials. One provider (20%) verbalized to the coinvestigator key points of patient education and their plan of care. For those providers who did not use the concussion toolkit materials, they were reminded they are available to use during patient education and may be dispersed to the patient, parent, school administrators, and coaches.

At the hypothetical follow-up examination of the mock-concussion patient, all the providers medically cleared the patient to return to sports when it was verbalized that the patient was without symptoms and had completed the return to play protocol without difficulty (100%). All providers denied medical clearance and wanted close follow-up when an alternative scenario was discussed: the patient continued to have mild physical symptoms and had not yet completed the return to play protocol (100%). All providers referred the patient on for symptoms lasting longer than six weeks (100%).

The key educational points demonstrated by the providers through completion of the return skill demonstration is represented below (see Figure 1). Throughout the return skill demonstration, the providers engaged in discussion about the concussion toolkit, SCAT5, and the overall evaluation and management of concussion patients. Five positive and negative comments were noted and are recorded in the tables below (see Tables 5 and 6). One positive comment was taken from each provider. Only three providers had negative comments with all negative comments being referred to the SCAT5 assessment tool.

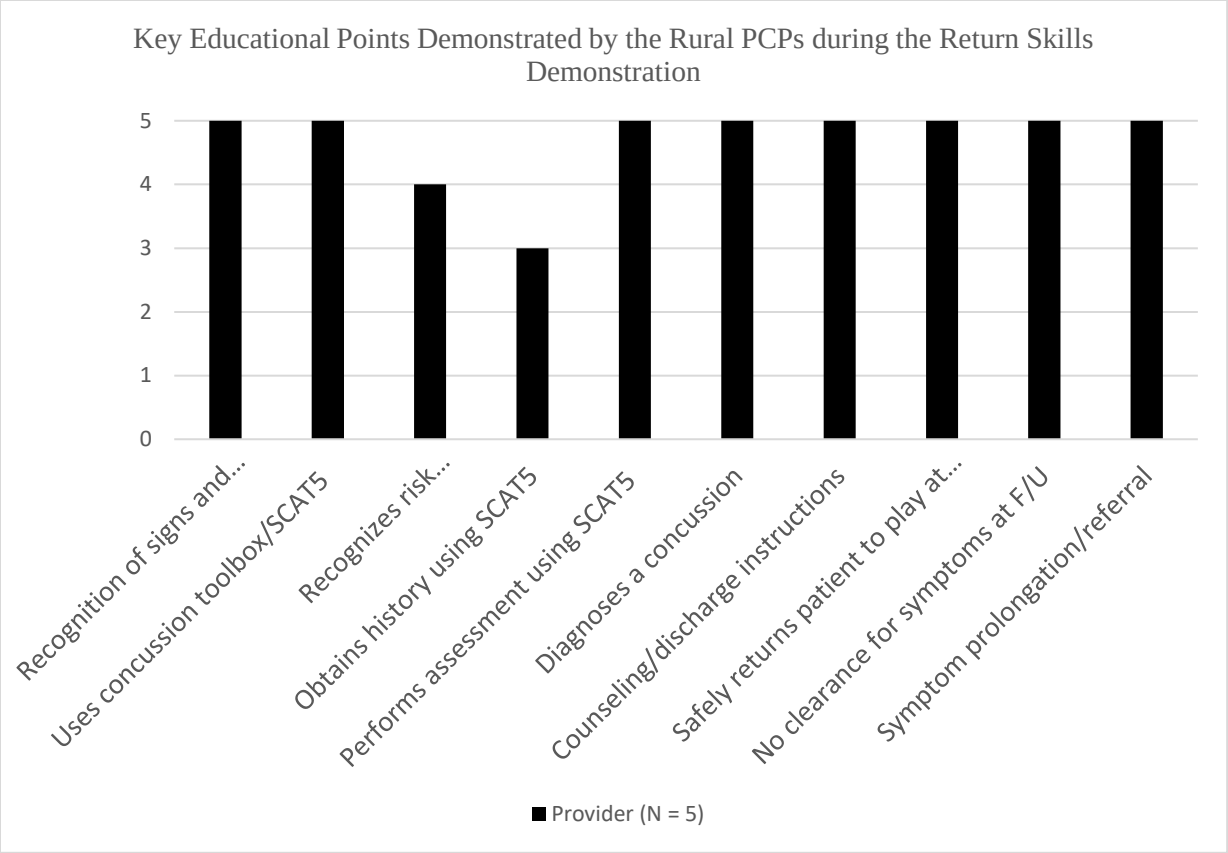

Figure 1. Key educational points demonstrated by the rural PCPs

Table 4

Positive comments made by PCPs during the return skill demonstration

Comment
"If we have this (discharge handout) to go over and send home with them to guide their return to sports, that will be very beneficial."
"I would like one of these (concussion toolkits) in the clinic and in the ER because we see them in both places."
"That's why I'm glad you're here to teach us this" (stated after coinvestigator assisted with scoring the SCAT5).
"It was nice to get to go through it once. It was very informative."
"Oh yeah, this will be really nice" (looking at patient education material). "We should make copies of this and put it in the ER."

Table 5

Negative comments made by PCPs during the return skill demonstration

Comment
"You know, this I would never ask. This would be hard, maybe too hard to do," (looking at months of the year in reverse order test).
"Some of these questions would be hard for kids" (referring to children younger than age 12).
"This is tough" (stated while performing the numbers backwards test).
"I could see where you would need to work with this (SCAT5) several times to become familiar with using it on a patient."
"It will definitely make me think awhile, with this scoring business" (referring to the SCAT5)

CHAPTER VI. DISCUSSION AND RECOMMENDATIONS

Interpretation of Results

The purpose of the project was to improve how primary care providers evaluate and manage concussion patients in the rural setting through the implementation of an evidence-based educational session, introduction of a concussion toolkit, and a return skill demonstration. All of the project objectives were achieved. As evidenced by the project results, the implementation of the educational session and return skill demonstration promoted the use of evidence-based evaluation and management practices and improved provider confidence. The results of each objective are interpreted and discussed below.

Objective One

The project objective aimed at improving access to and use of concussion EBP guidelines was met. Each rural health clinic was provided a concussion toolkit with EBP resources for concussion evaluation and management. Online resources were also provided so the PCPs can access the resources from any type of setting. Prior to the educational session, the providers completed a survey indicating their demographics and current concussion practices. The survey revealed that only three rural PCPs (60%) had previously used EBP guidelines to assist in the evaluation and management of concussion patients. After the implementation of the concussion educational session and return skill demonstration, all five providers (100%) reported they will likely use EBP to evaluate and manage care of a patient suspected of suffering from a concussion by using the concussion toolkit, SCAT5, and/or published concussion guidelines.

Objective Two

The project objective aimed at improving providers' knowledge and confidence in the evaluation and management of concussions was met. Based on the overall results of the self-

confidence evaluation survey, 86% of the responses by the providers indicated they "strongly agreed" that they were confident in concussion knowledge, evaluation, and management strategies after project implementation. Fifteen percent of respondents indicated they "somewhat agreed" that they are confident in their acquired concussion knowledge, evaluation, and management strategies. No respondents indicated they "somewhat disagreed" (0%) or "strongly disagreed" (0%) that they are confident in their acquired concussion knowledge, evaluation, and management strategies. Overall, the survey results demonstrated concussion knowledge acquisition and provider confidence in the evaluation and management of concussions.

Objective Three

The project objective in which providers applied their acquired knowledge and skills during a mock-clinic visit to further enhance confidence and demonstrate competence was met. The goal of the return skill demonstration was to provide rural PCPs an opportunity to practice using the concussion toolkit, or evidence-based practice, during the evaluation and management of rural concussion patients. Each rural PCP actively participated in the return skill demonstration. They also engaged in discussion with the coinvestigator during the return skill demonstration, often clarifying evaluation and/or management strategies and theorizing the use of the EBP tools in future patient encounters. During the return skill demonstration, the PCPs met the key educational points that demonstrated competence in concussion evaluation and management in the rural clinic setting.

Evaluating the Practice Change

While the Iowa Model of Evidence-Based Practice was key to developing and implementing the PIP, its application in evaluating the results of the PIP was somewhat limited based on the principle that evaluation took place immediately after the intervention, rather than

requiring ongoing monitoring and reporting of the process and outcomes. However, providers at both participating clinics reported the use of the concussion toolkit on multiple occasions in the primary care setting. One provider reported that the concussion toolkit was easy to navigate and provided the participant with confidence when diagnosing and managing the patient's concussion. Comments by the participating providers demonstrate the sustained integration of evidence-based concussion evaluation and management (Melnyck & Fineout-Overholt, 2015).

Logic Model

A logic model was developed to further implicate evaluation of the PIP (see Figure 2). Outputs are the result of activities (the project's intervention) (W. K. Kellogg Foundation, 2006). An output of the educational session was the knowledge transfer of concussion awareness, evaluation, and management. The goal of the educational session was to increase the knowledge and confidence of rural providers during concussion evaluation and management. The purpose of the concussion toolkit was to provide access to and promote the use of EBP concussion guidelines during concussion evaluation and management.

Outcomes are the changes that result from the educational session and return skill demonstration (W. K. Kellogg Foundation, 2006). The expected outcomes of the educational session and return skill demonstration included the use of and adherence to EBP guidelines and enhanced knowledge and self-confidence in concussion evaluation and management.

Impacts are the changes that are expected at the organizational, community, or system level (W. K. Kellogg, 2006). The educational session is expected to have an organizational and community impact. Providers voiced their intention to use the concussion toolkit with future concussion patients and were provided access to EBP concussion evaluation and management resources through the concussion toolkit. By increasing rural provider knowledge and

confidence, and providing an opportunity to practice using EBP during the evaluation and management of a mock-concussion patient, the expectation is that there will be reduced negative outcomes related to improperly diagnosed and managed concussions amongst youth in the participating rural communities.

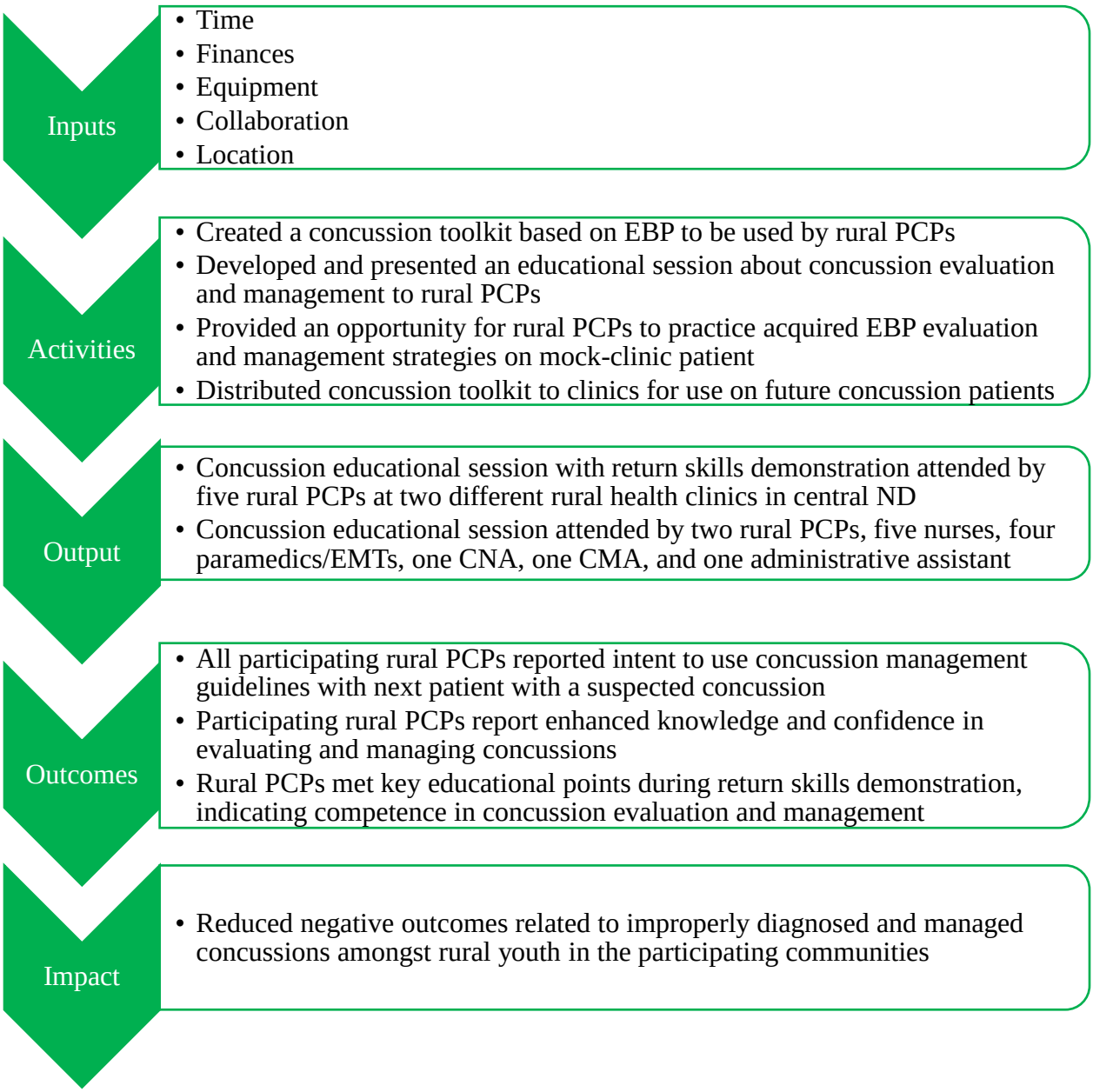

Figure 2. Logic model

Project Findings Compared to Review of Literature

Several of the project findings were consistent with the review of literature conducted by the coinvestigator during project planning. Review of literature revealed an inadequate use of concussion management guidelines amongst front-line health care providers, including NPs and PAs (Kleinjan, 2015; Zemek et al., 2014). A study conducted by Zemek et al. (2014) revealed that 70% of providers used published concussion guidelines to guide clinical decision making. Similarly, 60% of providers who participated in this PIP reported they had previously used published concussion guidelines prior to project implementation. After project implementation, 100% of the providers reported they will likely use concussion management guidelines to evaluate and manage care of a patient suspected of suffering from a concussion by using the concussion toolkit, SCAT5, and/or published concussion guidelines.

Lebrun et al. (2013) conducted a cross-sectional study to assess family practice physicians' concussion knowledge base and clinical practices. Study results revealed an inconsistent use of current published concussion guidelines and recommendations. Specifically, less than half of family physicians encouraged cognitive rest during concussion education and 11% used outdated grading scales when determining return to play recommendations (Lebrun et al., 2013). After the educational session and return skill demonstration, PIP results indicated 80% of providers "strongly agreed" they are confident in recommending cognitive rest and guiding a safe return to school and 100% of providers "strongly agreed" that they were confident in recommending physical rest and guiding a safe return to sports. In addition, 100% of providers discussed return to play and return to school recommendations with the mock-clinic patient during the return skill demonstration.

A retrospective study conducted by De Maio et al. (2014) evaluated health care provider discharge instructions given to school-aged patients in an emergency department following a concussion. Despite meeting diagnostic concussion criteria, 31% lacked a documented discharge diagnosis of "concussion." Furthermore, most patients (62%) were discharged home without concussion-specific instructions. After project implementation, 100% of the providers made a correct diagnosis of concussion during the return skill demonstration, and the self-confidence evaluation survey revealed that 80% of the providers "strongly agreed" they are confident in diagnosing a sports-related concussion. Additionally, 60% of the providers "strongly agreed" they are confident in counseling patients and parents about concussions and general concussion management strategies, 80% "strongly agreed" they are confident in recommending cognitive rest and guiding a safe return to school, and 100% "strongly agreed" that they were confident in recommending physical rest and guiding a safe return to sports. Furthermore, 100% of the providers provided concussion counseling and patient education, recommended a follow-up visit in one week to reevaluate concussion symptoms, and appropriately provided either medical clearance or recommended further follow-up based on the presence of concussion symptoms.

Recommendations made by the majority of studies evaluated during the review of literature included improved education and training for family practice providers and a need for adherence to concussion management guidelines (Carson et al., 2014; De Maio et al., 2014; Lebrun et al., 2013; Zemek et al., 2014). Meeting the purpose and outcomes of the PIP, the self-confidence evaluation survey results demonstrated concussion knowledge acquisition and provider confidence in the evaluation and management of concussions. The mock-clinic visit further enhanced confidence and providers demonstrated competence in concussion evaluation and management in the rural clinic setting.

At the time of PIP completion, the 2016 CISG concussion management consensus guidelines and SCAT5 remain the most up-to-date clinical practice guidelines for concussion evaluation and management (McCrory et al., 2017). The educational session information, concussion toolkit resources, and EBP concussion assessment tool were based on the 2016 CISG concussion management consensus guidelines making the PIP applicable to health care systems or future researchers looking to implement a similar project.

Project Limitations

A limitation to the PIP was the small sample size despite being conducted at two different rural clinic settings. Nine participants were originally anticipated to participate in the PIP. Two providers were not scheduled to work on the day of the PIP and chose not to return to the clinic site to participate. Seven rural providers attended the concussion educational session, however two providers were excluded from the evaluation process due to either a schedule conflict or an emergency. However, when analyzing the qualitative data, the sample size was deemed adequate because the PCPs met the key educational points during the return skill demonstration. In addition, the overall goal of the PIP was not to generate new research, but to increase the knowledge and confidence in rural primary care providers evaluating and managing concussion patients with evidence-based guidelines. Although not statistically significant, the PIP resulted in primary care providers who are confident and competent in providing evidence-based practice care to concussion patients in two rural communities in North Dakota.

Another limitation to the PIP is that the setting and participants were chosen by the coinvestigator after completing clinical rotations with a few of the rural providers. A prior student-preceptor relationship between the coinvestigator and the participants may have influenced the participants' survey responses. To combat this limitation, the coinvestigator

provided a disclaimer to answer the evaluation survey honestly and provided a private area to complete and submit the evaluation survey. However, the working relationship would not have been a factor when the providers completed the return skill demonstration, as evaluation was completed by the coinvestigator's observations and were not based on the participants' responses.

Finally, the long-term impact on rural concussion patients is unknown as there was not a retrospective chart audit conducted after implementation of the educational session. Based on the premise that concussion patients may not present to the participating rural health clinics during project implementation and was not a necessary contribution to meeting project outcomes, a chart audit was omitted. In addition, the clinic sites used different electronic health records (EHR) and one clinic reported much difficulty in making any changes or accessing information from their outdated EHR. Therefore, the documented long-term impact on concussion patients is beyond the scope of this PIP. Nonetheless, the anticipated long-term impact is that with the additional education and knowledge and application of EBP resources, providers will adhere to EBP guidelines, and rural concussion patients will have better outcomes. See Recommendations for further discussion on this topic.

Adjustments

During the development of the PIP, adjustments were made to the original proposed project. Initially, a final evaluation was to be completed by the providers at the end of the fall high school sport season in November 2017. The final evaluation was going to be a concussion case-study to determine if providers could effectively care for a concussion patient. However, it was thought to be more useful to determine the knowledge and confidence acquired immediately after project implementation. In addition, the providers would be practicing the use of the

concussion toolkit and SCAT5 in the office on a mock patient which appeared to be a better indication of whether they could evaluate and care for concussions. Therefore, the proposed final case study evaluation, which was to be completed approximately 12-weeks after project implementation, was redundant in meeting the project outcomes and was eliminated.

During PIP implementation, an adjustment was made as to how the return skill demonstration was conducted and subsequently evaluated. Instead of answering questions on a case study read orally by the coinvestigator, the PCPs treated the return skill demonstration as an actual clinic visit with a patient who had a suspected concussion. Questions in the case study were modified during real-time by the coinvestigator to reduce interruptions in the mock-clinic visit, making the patient encounter as realistic as possible for the providers.

Additionally, project implementation was supposed to occur in early August, prior to the start of the fall high school sport season in an effort to educate PCPs about concussions prior to football and volleyball seasons. However, due to the difficulties of arranging the PCPs schedules for a common time to meet, especially due to summer vacations, the PIP was implemented two weeks later than desired at LMC and four weeks later at WFC.

Implications for Advanced Practice Nursing

Despite the surge in concussion awareness and the overwhelming evidence to support the use of evidence-based assessment tools and guideline adherence during the evaluation and management of concussions, a gap in concussion knowledge and adherence to concussion management guidelines amongst primary care providers exists (Mrazik et al., 2015; Zemek et al., 2014). The primary care nurse practitioner workforce is growing more rapidly than the primary care physician workforce (Health Resources & Services Administration [HRSA], 2013). For that reason, providing concussion education to the chosen sample, 80% were nurse practitioners, was

an important step in expanding concussion knowledge amongst primary care nurse practitioners. In addition, nurse practitioners help to offset the nation-wide shortage of primary care providers, especially in rural areas. Rural health care has a unique set of challenges, with access to specialist providers, such as concussion specialists and neuropsychologists, being a common one. With a lack of specialists, rural primary care providers are expected to offer expertise in an array of populations and areas. Although the PIP was implemented at only two clinical sites, the project proved to be impactful for the rural primary care providers who reported enhanced knowledge and confidence in caring for youth concussions in clinical practice. When confident in the care provided to patients, rural primary care nurse practitioners may perceive the lack of specialty providers and physicians as a positive opportunity to work independently and may be considered a satisfying attribute of rural health care.

Nurse practitioners bring a comprehensive prospective to the health care team. Nurse practitioners in the primary care setting use evidence-based practice guidelines, as well as their acquired clinical expertise, to diagnose and treat a variety of health conditions and injuries in the clinical setting with an added emphasis in disease and injury prevention and health promotion. Considering nurse practitioners in the rural primary care setting care for patients throughout the life-span with diverse health conditions and injuries, a commitment to life-long education is a requirement to providing high-quality patient care. Providing an interactive, concussion educational session to the participating rural primary care providers not only allowed knowledge acquisition, but hopefully was a motivating factor for further research and learning opportunities for the rural PCPs. Additionally, with a focus on disease prevention, rural PCPs can counsel about concussion prevention and recognition during future preparticipation physical examinations. With continual education, as provided in this PIP, and a commitment to staying

up-to-date on evidence-based guidelines, PCPs have the knowledge and tools necessary not only to evaluate and manage health conditions, such as concussions, but also to prevent disease and promote patient well-being. Ultimately, providing education to rural primary care providers regarding the latest evidence-based practices promotes high-quality patient care and optimal health outcomes for individuals, families, and the rural community in which they reside.

Dissemination

Dissemination is the final step of the Iowa Model of Evidence-Based Practice and is a vital step in advancing professional practice and promoting adoption of EBPs (Melnyck & Fineout-Overholt, 2015). Dissemination of concussion awareness has been completed during project completion, and the project results and recommendations are planned to be disseminated in several ways. The coinvestigator presented the PIP plan and expected results at the North Dakota Diabetes Summit in March 2017 and at the North Dakota Nurse Practitioner Association's Pharmacology Conference in September 2017. Dissemination of the project findings and recommendations will be presented at the NDSU Nursing at Sanford Health Bismarck Research Day on May 2, 2018. The NDSU Research Day is an event where undergraduate nursing students and graduate DNP students present their respective evidence-based research and PIP findings to cohorts, Sanford Health Bismarck providers, nurses, and administrators, and the community. In addition, the coinvestigator will submit an informational article to the *Emmons County Record* and *Washburn Leader News*, the participating rural clinics' local newspapers. The intended audience of the article includes the participating rural providers, parents, coaches, teachers, and athletes within the rural community in which the PIP was completed. Publication of the importance of EBP evaluation and management of concussions

supports the growth of an EBP culture within the participating rural health clinics and enhances concussion awareness in rural ND communities (Melnyck & Fineout-Overholt, 2015).

Recommendations for Future Practice Improvement Projects

With the ever-growing body of research regarding concussions and traumatic brain injuries, it is likely that future DNP students may develop a PIP on concussion evaluation and management or expand on the coinvestigator's PIP. A similar project, with a retrospective chart audit, could further deduce the effect of an EBP initiative directing the health care service delivery on concussion patients. I recommend offering more than one educational session at each clinic site to reach those providers that were unable to attend due to schedule conflicts. Furthermore, contacting more clinic sites reaches a larger patient population, likely increasing the incidence of concussion patients presenting to the rural clinic setting, which would be needed for a correlational study.

While I do think that the educational session and return skill demonstration (practicing the SCAT5 and educating a mock patient during project implementation) was an effective intervention, it required a 50 to 60-minute time commitment during the provider's work day. To compensate the PCPs for the time and effort they invested in the PIP, I recommend investigating into approval for one hour of Continue Medical Education (CME) by the American Academy of Nurse Practitioners (AANP).

During the review of literature, it was found that the knowledge transfer of concussion awareness is an effective strategy in preventing concussions (McCrory et al., 2017). The coinvestigator recommends taking a preventative approach by educating providers about concussion prevention measures including the use of the SCAT5 to be used as a baseline assessment. The preparticipation physical examination is an opportunity for the provider to

facilitate concussion reporting by the patient (Chinn & Porter, 2016). Encouraging PCPs to educate patients about self-assessment, signaling that a concussion has occurred (tapping the top of the head or helmet), and reporting concerns about a concussion to coaching staff could expedite concussion diagnosis and ensure proper management (Chinn & Porter, 2016). In addition, a PIP focused on a community educational session offered to parents, coaches, and teachers would enhance the likelihood of concussion patients presenting to the rural primary care clinic for proper evaluation and management.

Conclusion

The practice improvement project's purpose was to improve the care provided to youth concussion patients in two rural North Dakota communities. The development and presentation of a concussion educational session, return skill demonstration, and a concussion toolkit based on existing evidence-based research, guidelines, and tool proved to be an effective intervention in improving the knowledge and practice of the participating rural primary care providers. As a result of the project, I am confident that these rural primary care providers will use their enhanced knowledge and skills during future encounters with patients suspected of suffering from a concussion by adhering to evidence-based guidelines. By promoting the use of evidence-based practices during concussion evaluation and management, youth residing in rural North Dakota communities are less likely to succumb to both short-term and long-term negative outcomes associated with concussions.

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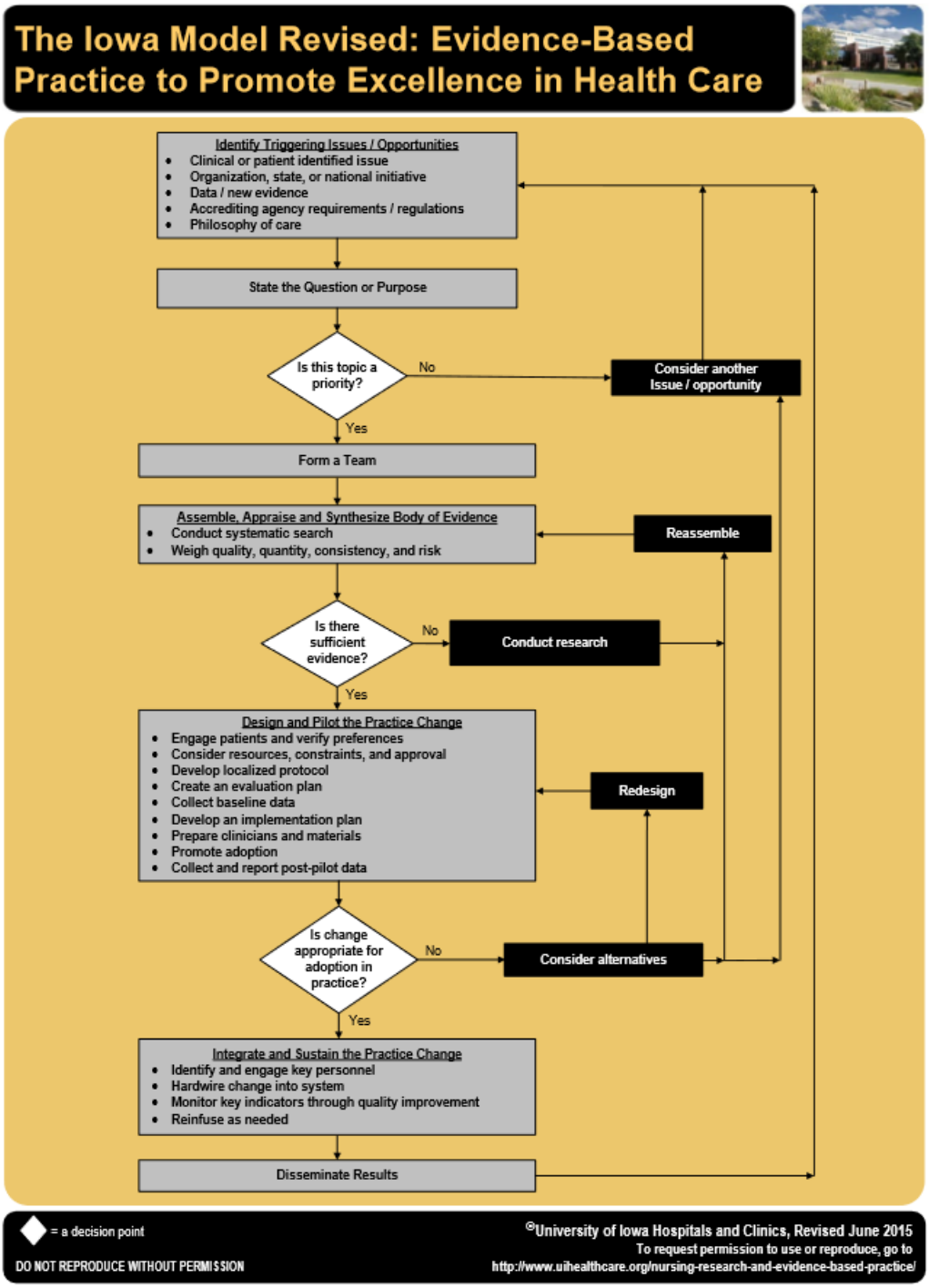
APPENDIX A. THE IOWA MODEL OF EVIDENCE-BASED PRACTICE TO PROMOTE QUALITY CARE



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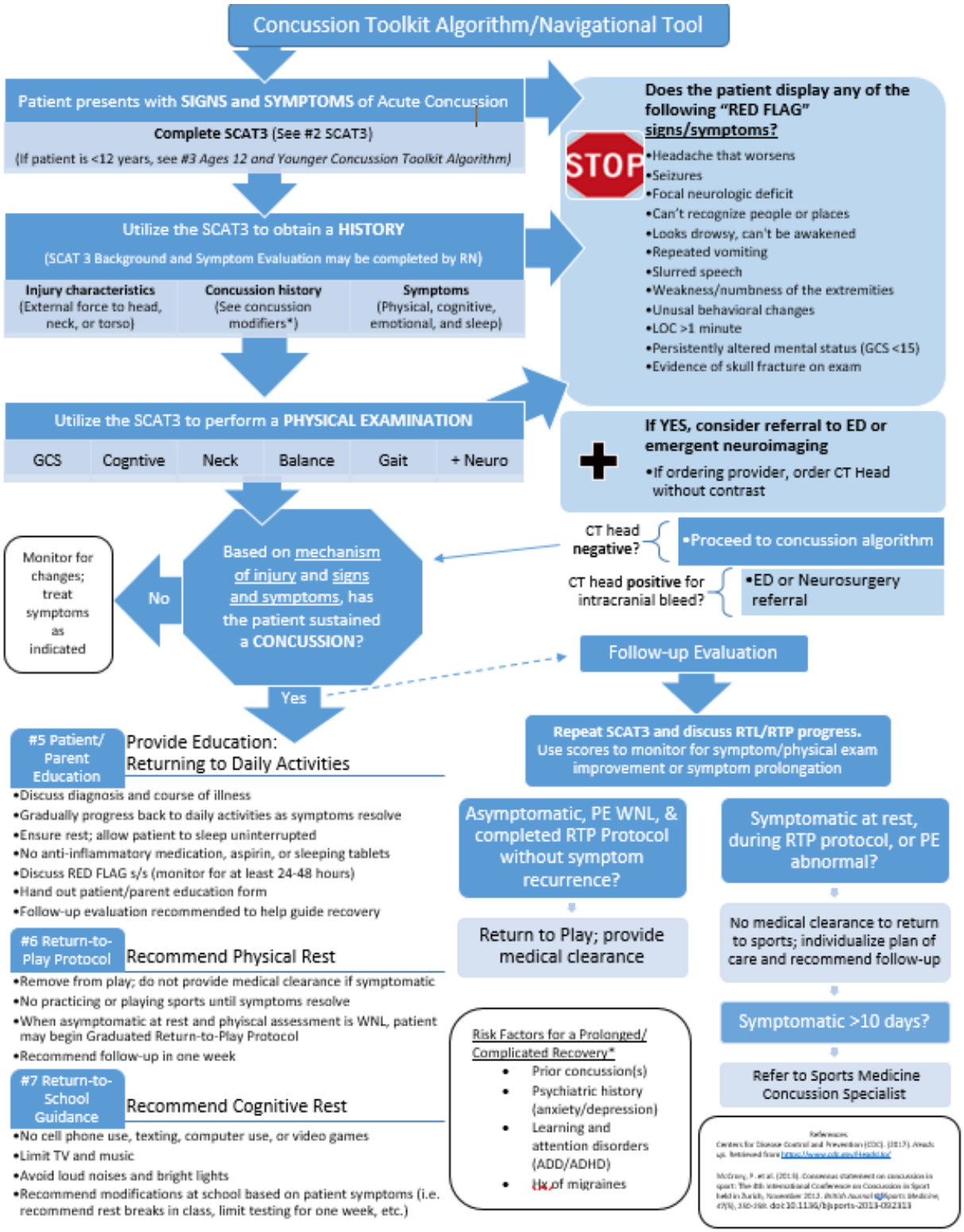
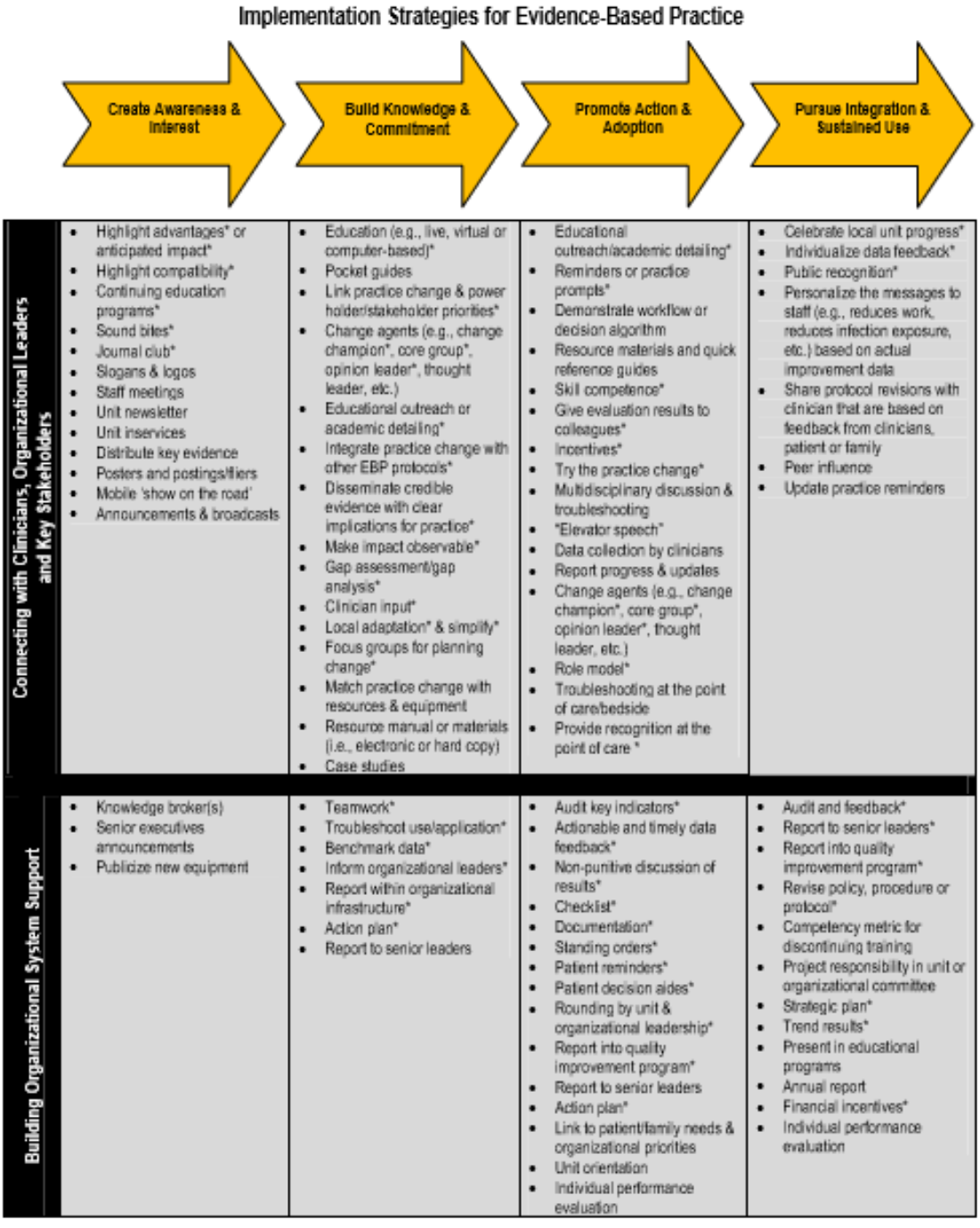
APPENDIX B. CONCUSSION TOOLKIT NAVIGATIONAL TOOL



APPENDIX C. IMPLEMENTATION STRATEGES FOR EVIDENCE-BASED PRACTICE



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APPENDIX D. CONCUSSION EDUCATIONAL SESSION POWERPOINT

Evidence-Based Management of Youth Concussion in a Rural Primary Care Setting

Josie J. Senger
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Department of Nursing

NDSU NORTH DAKOTA STATE UNIVERSITY

Objectives

- Enhance the PCPs knowledge, awareness, and legal responsibilities of concussion management
- Identify signs and symptoms and use concussion-specific assessment techniques to make concussion diagnosis
- Understand concussion management strategies, including initial treatment and principles of safe return to sport and return to school
- Recognize prolonged or worsening concussion symptoms and make proper referrals
- Enhance use of guidelines and resources for concussion diagnosis and management

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Concussion

- Rotational or acceleration forces to the head, face, neck or elsewhere causes a complex neurometabolic cascade of events on the brain
- Rapid onset of short-lived neurological impairment that resolves spontaneously
- Signs and symptoms reflect a functional disturbance rather than a structural injury
  - Signs and symptoms usually follow a sequential course, but may be prolonged
  - At risk for further injury until homeostasis reestablished

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Why is management important to rural PCPs?

- Increased concussion awareness and incidence
  - Primary care clinic has emerged as the leading location for youth concussion management
- Rural patients at greater risk for symptom prolongation, recurrence, and complications
- Consequences of misevaluation can be fatal
- Teaching point: Know (where to find) your guidelines!

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North Dakota Concussion Management Law (2011)

- "The student is not allowed to return to practice, training, or competition until authorized, in writing, by a licensed health care provider"
- "The health care provider's signed authorization is acknowledging they are… trained in the evaluation and management of concussion"
- Health care professionals are not protected from civil liability

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Consequences of Premature Return to Sport

- Second impact syndrome (SIS)
  - Rare, but fatal
  - Result of a second or repeated head injuries before symptoms of initial concussion subside
  - Causes diffuse cerebral swelling, herniation, and death
- Little known about the long-term consequences of concussions in young athletes

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Signs and Symptoms

Physical Signs	Amnesia, confusion, LOC	Headache, nausea or vomiting	Dizziness, balance problems, fatigue	Phonophobia, photophobia, blurred vision
Cognitive Impairment	Repeating questions, delayed response	Feeling dazed, slowed reaction times,	Difficulty concentrating or remembering	Mental fogginess, difficulty learning new material
Emotional/ Mood	Emotional lability	Irritability	Sadness or depression	Nervousness or anxiety
Sleep/ wake	Insomnia	Difficulty falling asleep	Hypersomnia	

Standardized Concussion Assessment Tools

- Standardized tools used to assist health care providers in diagnosing concussion
- Sport Concussion Assessment Tool- 5th Ed. (SCAT5) (Concussion in Sport Group, 2017)
  - For use by medical professionals
  - SCAT5 should NOT be used by itself to make the diagnosis of concussion
  - Instructions within document and on page 857
  - Words in *italics* are the instructions to be given to the patient by the provider

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RED FLAG S/S:

Emergent CT Head w/out contrast

- Neck pain or tenderness
- Double vision
- Weakness or tingling of the extremities
- Severe or increasing HA
- Seizure
- Repeated vomiting
- LOC >1 minute
- Deteriorating conscious state
- Increasingly restless, agitated or combative
- Confusion (can't recognize faces or location)
- Evidence of skull fracture on exam

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Step 1: Athlete Background

- *RN/CNA may assist with completion
- Injury date/time
- Concussion history
- Risk factors for a complicated diagnosis or prolonged recovery
  - Prior head injury
  - HA disorder or migraines
  - Learning disorder (dyslexia)
  - Attention disorders (ADD/ADHD)
  - Psychiatric disorder (depression/anxiety)

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Step 2: Symptom Evaluation

- *RN/CNA may assist patient with completion
- Give the patient the symptom evaluation form
- Ask them to read instruction paragraph out loud and follow the instructions
- Patient completes the symptom scale based on concussion symptoms at this point in time
  - Total number of symptoms: ___/22
  - Symptom Severity score: ___/132
  - Do symptoms worsen with physical activity?
  - Do symptoms worsen with mental activity?

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Step 3: Cognitive Screening

- Orientation
  - Month?
  - Date?
  - Day of the week?
  - Year?
  - Time (within one hour)?
    - Orientation score: ___/5

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Step 3: Cognitive Screening (*cont.*)

- Immediate Memory
  - Choose one of the word lists (A-I)
  - Read each word aloud
  - Patient repeats as many words from the list as they can remember
  - Perform 3 trials using the same list, irrespective of the number correct on the first trial
    - Immediate memory score: ___/15 or ___/30

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Step 3: Cognitive Screening (*cont.*)

- Concentration
  - Digits Backwards
    - Choose one column of digits (List A-F)
    - Read each row or "string" of digits aloud
    - Patient repeats the digits in reverse order
    - If patient correctly repeats the string of digits backwards, move on the next string length
    - If incorrect, read trial 2 in same string length
    - Stop after incorrect on both trials
      - Digits score: __/4

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Step 3: Cognitive Screening (*cont.*)

- Concentration
  - Months in Reverse Order
    - Instruct patient to recite the months of the year in reverse order
      - Months score: ___/1
      - Concentration total score (Digits + Months): ___/5

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Step 4: Neurological Screen

- Read symptom scale aloud and followed its instructions?
- Full and pain-free passive cervical spine ROM?
- Looks side-to-side and up-and-down without double vision?
- Coordinated finger-to-nose test? (Five repetitions)
- Coordinated tandem gait? (Footwear removed)

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Step 4: Neurological Screen (*cont.*)

- Balance Examination (Modified Balance Error Scoring System [mBESS] Testing)
  - Three 20-second trials/stances are scored by counting the number of errors made in each stance, with hands on hips, and eyes closed
    - Stances: Double leg stance, single leg stance, tandem stance
    - Errors: Hands off of hips, opening eyes, step or stumble, moving hip >30 degrees abduction, lifting forefoot or heel, remaining out of position >5 sec
      - Total errors (3 stances each): __/30

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Step 5: Delayed Recall

- Ask patient to repeat the list of words previously used in Immediate Recall section
  - Performed after at least 5 minutes have elapsed
    - Total number of words recalled accurately: ___/5 *or* ___/10

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Step 6: Decision/Diagnosis

- Diagnosis includes MOI and one or more of the following domains:
  - Symptoms
    - Physical (HA, dizziness)
    - Behavioral/emotional changes (irritability)
    - Cognitive impairment (slowed reaction times
    - Sleep/wake disturbance (insomnia, hypersomnia)
  - Physical signs (LOC, amnesia, neurological deficit)
  - Balance impairment (gait unsteadiness)

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Child SCAT5

- Use for patients ages 5–12 years
  - Includes age-specific questions and assessment techniques and the parent's evaluation of the patient's symptoms
- The younger the patient is, the longer the recovery may take
- Conservative management strategies are recommended

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Discharge Instructions

- Counseling
  - Diagnosis of concussion and its implications
  - Suspected recovery time (7-10 days, but can be variable)
  - Present to ED for RED FLAG signs and symptoms
- Management
  - General management
  - Return to school strategy
  - Return to sport strategy
- Schedule follow-up evaluation to monitor recovery
  - As indicated, may provide medical clearance at follow-up

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General Management

- Gradually progress back to daily activities as symptoms resolve
- Brief period of initial rest (24-48 hours); allow to sleep
- Cognitive rest (limit screen time)
- Physical rest (avoid sports)
- Pharmacotherapy not supported
  - Symptom management: Sleep, rest in a dark, quiet room, cool washcloth to neck, avoid activities that aggravate symptoms
- Avoid NSAIDs, aspirin, narcotics, and sleeping pills
- Avoid alcohol and recreational drugs
- No driving

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Return to School Strategy

- A gradual progression of mental activities and school attendance
  - Limit cognitive activity to a level that doesn't exacerbate symptoms, but to make every effort to return the patient to school
  - If a mental activity worsens symptoms, stop and rest
- If mental activity during daily activities does not worsen symptoms, may return to school part-time (step 3)
- Recommend accommodations based on symptoms
  - The patient reports difficulty concentrating
    - "Until the patient has fully recovered, please postpone tests or major projects"

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Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

Return to Sport Strategy

- Stepwise, gradual exercise progression
- Start with light aerobic exercise (step 2) after:
  - Initial rest (24-48 hours)
  - Symptoms have resolved
  - Returned to full school days
- Proceed to next step when goal of each step is met without symptom recurrence
  - With worsening, must go back to the previous step
- Each step takes at least 24 hours, entire protocol will take at least 6 days, to complete

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Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

Follow-up Evaluation

Asymptomatic and completed RTP protocol?

- May return to play/sport
- Provide medical clearance

Symptomatic at rest or with activity?

- Do not return patient to play/sport
- No medical clearance
- Make modifications in plan of care
- Recommend follow-up
- Refer if symptomatic >4 weeks or if worsening

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When Should I Refer?

- Prognosis
  - Good
  - Majority resolve within 7-10 days
- Refer for concussion symptoms persisting for >4 weeks
  - Post-concussive syndrome
    - Vague concussion symptoms persisting for >3 months

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Referral Information

- CHI St. Alexius Archway Mental Health Services
  - Dr. David Brooks (Neuropsychologist)
  - (701) 530-5550
- Sanford Orthopedics and Sports Medicine
  - Dr. Jon Kolberg (Sports Medicine Concussion Specialist)
  - (701) 323-8999

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Concussion Management "Do's and Don'ts "

Don't

- Rush the evaluation or ignore serial assessments
- Allow pressure to cloud clinical decision-making
- Provide medical clearance in the presence of symptoms
- Hesitate to refer for symptom prolongation or worsening

Do

- Know how to find and use guidelines and resources to assess, diagnose, and manage concussion
- Recommend rest and educate patient and parent
- Provide guidance in returning to sport and school
- Follow-up with the patient

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Online Resources

- The 5th International Conference on Concussion in Sport (2017)
  - Consensus Statement on Concussion in Sport-
  - http://bjsm.bmj.com/content/51/11/838
- SCAT5 Sport Concussion Assessment Tool- 5th ed. (2017)
  - http://bjsm.bmj.com/content/bjsports/51/11/851.full.pdf
- Child SCAT5 Sport Concussion Assessment Tool- 5th ed.
  - http://bjsm.bmj.com/content/bjsports/51/11/862.full.pdf
- NDHSAA Concussion Management Procedure (2011)
  - https://ndhsaa.com/files/NDHSAA_Concussion_Policy.pdf

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Online Resources (*cont.*)

- CDC's "Heads Up: Concussion in High School Sports"
  - https://www.cdc.gov/headsup/providers/index.html
- The American Academy of Neurology (2013)
  - Summary of evidence-based guideline update: Evaluation and management of concussion in sports
  - http://www.neurology.org/content/80/24/2250.full
- The American Medical Society for Sports Medicine (2013)
  - Position statement: Concussion in Sport
  - http://physicians.cattonline.com/resources/files/amssm-position-statement-concussion-in-sport.pdf

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Disqualification from Sport

- How many concussions are "too many?"
  - No EBP guidelines
  - May want to refer for neurologic and neuropsychological testing
  - Each case carefully discussed and individualized approach to determine disqualification taken

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Neuropsychological (NP) Testing

- What is the role of neuropsychological (NP) testing in primary care?
  - Objective is to measure brain-behavior relationships
    - Tests attention, memory, processing speed, and reaction time
  - Most concussions can be managed without the use of NP testing; NP testing should not be used in isolation
  - Traditional (paper and pencil) Testing
    - Performed by a trained neuropsychologist
  - Computerized (ImPACT) Testing
    - Sensitive to mild concussion, easy to use
    - Expensive; should be interpreted by a trained professional

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APPENDIX E. DEMOGRAPHICS AND CURRENT CONCUSSION PRACTICES

1. Indicate your profession.
    a. Nurse Practitioner
    b. Physician Assistant
    c. Physician

2. How many years have you been in clinical practice?
    a. 0-2
    b. 3-6
    c. 7-15
    d. 16 or more

3. Approximately how many patients under the age of 18 did you diagnose or treat for a concussion within the past year (either initial visit or follow-up)? If 0, skip to question 7.
    a. 0
    b. 1-2
    c. 3-4
    d. 5 or more

4. If you have treated a patient(s) for a concussion within the past year, was he or she seen in the clinic, emergency department, or both? (May circle more than one answer).
    a. Clinic
    b. Emergency Department

5. If you treated a patient for a concussion within the past year, did you use evidence-based practice guidelines to aid in the diagnosis and/or management?
    a. Yes (please identify the resource/guideline used): _____
    b. No

6. What are barriers to evidence-based practice guideline use when diagnosing and managing concussion in the rural health care setting? (May choose more than one answer).
    a. Lack of awareness of existing published guidelines
    b. Inability to access existing published guidelines
    c. Published guidelines are not user friendly/confusing
    d. Lack of time
    e. Previous clinical experience is used to diagnose and mange concussions
    f. No barriers, I use EBP/published guidelines when assessing and managing concussions

7. During your graduate education for your degree, did you learn how to assess, diagnose, or manage concussion?
    a. Yes
    b. No
    c. Other (please explain): _____

8. During your current position, have you completed additional training/education for concussion assessment, diagnosis, or management (CME, CEU, CDC, other?)
    a. Yes (please explain): _____
    b. No

APPENDIX F. SCREENSHOT OF RETURN SKILL DEMONSTRATION

Image used with verbal consent from the participating rural health care provider and mock-concussion patient/DNP student.

APPENDIX G. SELF-CONFIDENCE EVALUATION SURVEY

Please respond to the following 14 statements by circling your response. (1) Do Not Agree with the statement; (2) Somewhat Disagree with the statement; (3) Somewhat Agree with the statement; and (4) Strongly Agree with the statement.

Statement	Do Not Agree	Somewhat Disagree	Somewhat Agree	Strongly Agree
I am confident in my ability to recognize danger ("RED FLAG") signs and symptoms and initiate emergency management.	1	2	3	4
I am confident in my ability to obtain a history specific to a patient with a suspected concussion.	1	2	3	4
I am confident in my ability to complete a physical assessment specific to a patient with a suspected concussion.	1	2	3	4
I am confident in my ability to diagnose a sports-related concussion.	1	2	3	4
I am confident in counseling patients and parents about concussions and educating about general concussion management strategies.	1	2	3	4
I am confident in recommending cognitive rest and guiding a safe return to school.	1	2	3	4
I am confident in recommending physical rest and guiding a safe return to sports.	1	2	3	4
I am aware of the North Dakota Concussion Law.	1	2	3	4
I am confident I am acting within my scope of practice, and I am trained in the evaluation and management of concussion when providing medical clearance to rural student athletes.	1	2	3	4
I am aware patients should not return to sports in the presence of symptoms, and I am confident I will not provide medical clearance to return to sports in the presence of concussion symptoms.	1	2	3	4
I am confident in recommending a follow-up evaluation at the initial office visit.	1	2	3	4
I am confident in my ability to recognize worsening or prolonged concussion symptoms.	1	2	3	4
I am confident in my ability to make referrals for worsening or prolonged concussion symptoms.	1	2	3	4
I will likely use the concussion toolkit, SCAT5, or published concussion guidelines during my next encounter with a pediatric patient presenting with a suspected concussion.	1	2	3	4

APPENDIX H. RETURN SKILL DEMONSTRATION KEY EDUCATIONAL POINTS

Patient Name: Taylor
Age: 17
CC: Headache
HPI: Taylor developed a headache yesterday afternoon after hitting heads with a teammate while diving for a volleyball in practice. She denies LOC, amnesia, or disorientation. She developed a headache shortly after practice. Her headache has remained unchanged, rating it a "dull" "4" out of 10. She reports her symptoms are similar to the concussion she experienced approximately one year ago, which occurred during a basketball game.

1. Do you suspect a concussion?

2. Would you utilize the concussion toolkit, SCAT5, or any other EBP resources to assist with obtaining a thorough history pertinent to concussion?

3. Based on the history given and the SCAT5, does Taylor have any risk factors that may complicate her diagnoses or prolong her recovery process?

4. Please use the SCAT5 to complete following EBP physical assessments:
    a. Step 3: Cognitive screening
        i. Orientation
        ii. Immediate memory
        iii. Concentration
            1. Digits backwards
            2. Months in reverse order
    b. Step 4: Neurological Screen
        i. Balance examination: Modified Balance Error Scoring System (BESS)
    c. Step 5: Delayed Recall

5. Based on the injury characteristics, signs and symptoms, and SCAT 5 history and physical examination, would you diagnose Taylor with a concussion?

6. Devise a plan of care and proceed with patient education and concussion management strategies. (May utilize the Concussion Toolkit, see #5 Patient/Parent Education).

7. As you instructed, Taylor returns to your office in one week. She is without physical, cognitive, emotional, or sleep symptoms and has completed the return to play protocol. What is your next step?

8. As you instructed, Taylor returns to your office in one week. She is with mild cognitive symptoms and is has one more day left in the return to play protocol. What is your next step?

9. Taylor returns to your office 6 weeks later. She reports persistent intermittent dizziness that is exacerbated by activity and difficulty falling asleep. What is your next step?

APPENDIX I. NDSU IRB APPROVAL LETTER

NDSU NORTH DAKOTA STATE UNIVERSITY

June 30, 2017

Dr. Dean Gross
Nursing

Re: IRB Determination of Exempt Human Subjects Research:
Protocol #PH17271, "A Concussion Toolkit Educational Session: Promoting Evidence-Based Management of Youth Concussion in a Rural Primary Care Setting"

Co-investigator(s) and research team: Josie Senger
Certification Date: 6/30/2017 Expiration Date: 6/29/2020
Study site(s): Linton Hospital and Clinics, Washburn Family Clinic
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category #1) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the original protocol submission (received 6/27/2017) with updated consent (received 6/30/2017).

Please also note the following:
- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

Kristy Shirley

Digitally signed by Kristy Shirley
DN: cn=Kristy Shirley, o=NDSU, [illegible] Administrator, email=kristy.shirley@ndsu.edu, c=US
Date: 2017.06.30 10:24:55 -05'00'

For more information regarding IRB Office submissions and guidelines, please consult http://www.ndsu.edu/research/integrity_compliance/irb/. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD
NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb
Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

APPENDIX J. INFORMED CONSENT

North Dakota State University (NDSU) Department of Nursing
NDSU Dept. 2670 PO Box 6050
Fargo, ND 58108-6050 Phone: (701) 231-7395

Title of Research Study: **A Concussion Toolkit Educational Session: Promoting Evidence-Based Management of Youth Concussion in a Rural Primary Care Setting**

Dear Rural Health Care Provider:
My Name is Josie Senger. I am currently a family nurse practitioner student obtaining by doctorate at North Dakota State University. I am conducting a practice improvement project to improve the health care provided to youth patients in the primary care setting who experience a sports-related concussion in rural North Dakota. By participating in this project, it is my hope that primary care providers (PCPs) will have the resources, knowledge, and confidence to make evidence-based clinical decisions and have better management strategies when caring for a patient with a concussion in the rural setting.
As a rural PCP, you are invited to take part in this practice improvement project. Participation is your choice, and you may change your mind or quit participating at any time.
Reasonable safeguards have been implemented to minimize risks to the participant. There are no foreseeable risks to the rural PCP participating in the practice improvement project.
By participating in the project, providers are likely to benefit from the additional concussion education and resources. Specifically, the providers may have enhanced ability to diagnose and manage young athletes with concussion in the rural setting. There is the possibility that the rural PCP has advanced knowledge in concussion diagnosis and management. Therefore, you may not benefit from the practice improvement project, but will still have the resources available for use.
The tests and surveys you complete will not have patient identifiers and will be combined with information from other PCPs taking part in the project. A dissertation will be written about the results obtained. The results of the study may be published, but any identifying information will be kept private.
If you have any questions about this practice improvement project, please contact me at (701) 471-2812 or josie.senger@ndsu.edu or contact my Committee Chair Dr. Dean Gross at (701) 231-8355 or dean.gross@ndsu.edu.
You have rights as a research participant. If you have questions about your rights or complaints about this practice improvement project you may contact a researcher or the NDSU Human Research Protection Program at (701) 231-8908, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050.

Thank you for your time and taking part in this practice improvement project.

Sincerely,

Josie J. Senger, RN, BSN, DNP/FNP-Student

I have been made aware of potential risks and benefits of the practice improvement project, and I am providing my informed consent to participate in the following practice improvement project**:** **A Concussion Toolkit Educational Session: Promoting Evidence-Based Management of Youth Concussion in a Rural Primary Care Setting.**

Printed Name: _____

Signature: _____

EXECUTIVE SUMMARY

CONCUSSION EDUCATIONAL SESSION AND RETURN SKILL DEMONSTRATION IN THE RURAL PRIMARY CARE SETTING

PARTICIPANTS AND SETTING

The educational session and return skill demonstration was attended by five primary care providers at two rural clinics.

PROJECT FINDINGS

- 100% of the rural PCPs reported they will use EBP guidelines to evaluate and manage concussions
- 86% of the responses by rural PCPs indicated they "strongly agreed" that they were confident in concussion knowledge, evaluation, and management strategies after project implementation
- Each rural PCP achieved the key educational points and actively participated in the return skill demonstration that demonstrated competence in concussion evaluation and management

INTRODUCTION

Youth patients who experience a concussion may experience devastating consequences which may temporarily or permanently adversely affect his or her performance in the athletic or academic and may result in physical symptoms and illness, emotional problems, and sleep difficulties.

Over the past decade, concussion in youth sports has becoming a growing health care concern, as there is increased awareness that all concussions are a form of traumatic brain injury and require proper evaluation and treatment by a health care professional to reduce the negative outcomes associated with concussions. This document offers an educational approach to enhance the evaluation and management of youth concussion patients in rural communities.

PROBLEMS FACED BY RURAL PRIMARY CARE PROVIDERS

Evidence shows a considerable gap in concussion knowledge and adherence to concussion management guidelines amongst primary care providers (PCPs).

- Primary care clinics are the leading location of health care delivery for young athletes with concussion; 94% of PCPs see, assess, and manage concussions
- PCPs in rural settings lack resources and access to concussion specialists

PROJECT DESIGN

The purpose of the project was to increase rural PCPs' concussion knowledge and promote the use of evidence-based concussion management practices.

Project implementation included education on the latest evidence-based concussion management guidelines, resources for clinical

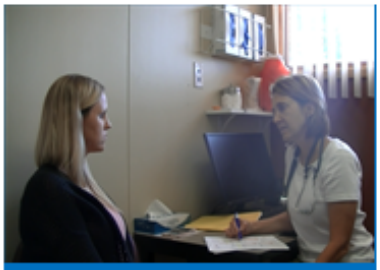

Figure 2: A rural PCP examines the mock-concussion patient during project implementation.

Contact Information

Josie J. Senger

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- 341 Freiburg Lane
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- 701.471.2812
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practice provided in a concussion toolkit, and each PCP was provided an opportunity to evaluate and treat a mock-concussion patient using concussion management guidelines during a return skill demonstration.

Project evaluation included both quantitative and qualitative data analysis by means of provider self-report via a self-confidence evaluation survey and direct observation of the return skill demonstration.

RECOMMENDATIONS

Enhanced concussion awareness and additional education and training opportunities for primary care providers who evaluate and manage concussion is supported by current literature.

Recommendations

- Invite coninvestigator to present the concussion educational session with return skill demonstration to enhance provider knowledge and confidence
- Compile concussion management guideline resources and create a tangible concussion toolkit or create an electronic medical record concussion template for initial examination (incorporating SCAT5 testing) and follow-up examinations
- Incorporate opportunities to practice evidence-based concussion assessment tools (SCAT5) to promote guideline adoption and improve provider efficiency
- Provide patient and parent education about the importance of timely concussion evaluation and treatment, concussion signs and symptoms, and when to seek healthcare at each preparticipation sports physical examination

Potential Benefits

- Enhanced concussion awareness and knowledge
- Enhanced confidence in evaluating and treating concussions in the primary care setting
- Promote a culture of evidence-based practices with the health care system
- Reduced short-term and long-term negative outcomes experienced by youth concussion patients

CONCLUSION

Considering nurse practitioners in the rural primary care setting provider comprehensive care for patients throughout the life-span with diverse health conditions and injuries, a commitment to life-long education and adherence to current evidence-based guidelines is required in providing high-quality patient care.

When rural PCPs are provided a comprehensive concussion educational program, they are likely to gain concussion knowledge, self-confidence, and adhere to evidence-based guidelines when evaluating and treating youth concussion patients leading to enhanced patient outcomes