DEVELOPMENT AND EVALUATION OF A CLINICAL PRACTICE GUIDELINE TO PROMOTE EVIDENCE-BASED TREATMENT OF PEDIATRIC CONCUSSIONS IN PRIMARY CARE

by

Brett Jerome Mortenson

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As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Brett Jerome Mortenson entitled Development and Evaluation of a Clinical Practice Guideline to Promote Evidence-Based Treatment of Pediatric Concussions in Primary Care and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

_____ Date: November 18, 2016
Gloanna Peek, PhD, RN, CPNP

_____ Date: November 18, 2016
Luz Wiley, DNP, RN, APRN-BC

_____ Date: November 18, 2016
Lorri Marie Phipps, DNP, RN, CPNP

Final approval and acceptance of this DNP Project is contingent upon the candidate's submission of the final copies of the DNP Project to the Graduate College.

I hereby certify that I have read this DNP Project prepared under my direction and recommend that it be accepted as fulfilling the DNP Project requirement.

_____ Date: November 18, 2016
DNP Project Director: Gloanna Peek, PhD, RN, CPNP

STATEMENT BY AUTHOR

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SIGNED: Brett Jerome Mortenson

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DEDICATION

I would like to dedicate this work to my children and family. Through your love and support, I have found what I love to do. I hope to continue on this journey and help other families that are struggling with health concerns and impart some love and peace into their lives because of the love I have received. I am grateful for you all. S.D.G.

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ABSTRACT

Introduction and Rationale: Concussions account for the majority of traumatic brain injuries in children. Currently there more than 500,000 pediatric concussions per year and that number is likely low due to under-reporting (Rose, Weber, Collen, & Heyer, 2015). Most symptoms of concussion are easily recognized to the trained pediatric primary care provider. Yet, symptom management and recommendations for rest, exercise, specialty care referral, and return to normal activities can be challenging for many providers, due to the lack of evidence and lack of formal recommendations by any organization (Rose et al., 2015; Silverberg & Iverson, 2013).

Purpose and Objective: The main purpose of this Doctor of Nursing Practice (DNP) project is to develop evidence-based clinical practice guidelines (CPG) for pediatric primary care providers. The objective is to provide a CPG that offers clinical guidance when managing pediatric concussion patients in the primary care setting. This CPG will also provide clarity for pediatric primary care providers (PCP) when determining what options are available in treatment for pediatric concussions.

Methods: The working framework of this project was The Appraisal of Guidelines for Research & Evaluation II (AGREE II). The American Academy of Pediatrics (AAP) procedure for reporting clinical guidelines, in the form of key action statements, was used as the model for development of the CPG.

Results: The CPG was appraised using the AGREE II instrument, which provides valid and reliable scores and data used in the evaluation of CPG's. Six domains were evaluated, and the CPG yielded scores above 80% for all categories. The overall standard deviation was 0, which indicts a very low level of discrepancy between users of the instrument.

Conclusion: This DNP project addresses an evidence and primary care practice gap. With a large number of pediatric concussions, a consistent management approach will ensure a safe and therapeutic recovery. A CPG was developed and evaluated using the AGREE II instrument. The CPG was found to meet the standards for general recommended use in pediatric primary care.

CHAPTER I: OVERVIEW

Introduction

Each year the number of young adults and children presenting to clinics or emergency settings for concussion evaluation is rising (Stache, Howell, & Meehan, 2016). It is reported that each year there are half a million traumatic brain injuries (TBI) in children (Talavage, Nauman, & Leverenz, 2016) and per the Centers for Disease Control and Prevention (CDC) 75% of all TBIs each year are concussions (CDCb, 2016). Specifically, there is an increased awareness of the problem of rising concussion rates among young athletes (Centers for Disease Control and Prevention, 2011; Stache et al., 2016). Given this information it is clear that to provide the best care to the pediatric population there is a need to have common recommendation on therapeutic treatment or rehabilitation following a concussion. The purpose of this Doctor of Nursing Practice (DNP) project is to provide pediatric primary care providers (PCP) with an evidence-based clinical practice guidance that will help manage concussion patients. The clinical practice guideline (CPG) is designed to be used by the pediatric PCP in order to better provide education and care to the pediatric patient and family. This chapter will address the definitions of concussions and relating terms, along with significance to advanced practice nursing in order to help provide understanding for the need of a project of this nature.

Pediatric Concussions

According to the 2012 Zurich Consensus Statement, concussion is defined as "a complex pathophysiological process affecting the brain, induced by biomechanical forces..., which may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an 'impulsive' force transmitted to the head" (Leddy et al., 2015; McCrory et al., 2013) (American

Academy of Neurology, 2013). The CDC expands on this description by adding that concussions are the most common form of traumatic brain injuries (TBI) and cause temporary loss of normal cerebral functioning (CDCb, 2016)(Wells, Goodkin, & Griesbach, 2015).

The data is strong that pediatric concussions are on the rise. Improved diagnostic criteria and awareness of concussions are helping to fine tune the true magnitude of the problem. Currently it is estimated that 1.6 – 3.8 million sport-related TBIs are reported each year (Rose et al., 2015). As mentioned, over 500,000 of all TBI's are pediatric patients (Stache et al., 2016; Zemek et al., 2016). It is also estimated that each year about 100,000 school-aged children present to the emergency department (ED) for concussion management (Rose et al., 2015). This is number works out to about 1 in every 220 pediatrics patients that present to the ED being diagnosed with a concussion (Rose et al., 2015). Many sources admit that concussion in youth is likely underreported and a result of a lack of awareness of severity on the part of parents, guardians or coaches (Rose et al., 2015). Some patients do not think their injury is severe enough to seek medical attention and this adds to underreporting as well. Of the pediatric concussions that are estimated to occur, anywhere from 30-50% are sport-related (Giza et al., 2013; Rose et al., 2015). Concussions that are non-sport related and the overall patient population with the most TBIs are the 0-4 year-old age range (CDCb, 2016). This number has increased, likely due to awareness of dangers related to head injuries in general, although motor vehicle accidents and accidents in general account for a significant number of TBIs (CDCb, 2016). Of increasing importance are the sport-related concussions. Sport-related concussions are of great interest because of the level of prevention and recognition that can help mitigate long term outcomes, such as lingering academic underperformance, physical manifestations and emotional

ramifications. Concussion rates among sports varies with sex and sport. Sport-related concussions are, overall, more prevalent in girls athletics, but the highest rate of concussions in any given sport would be boys football (Giza et al., 2013; Rose et al., 2015). The breakdown of sport-related concussions per sport in relation to total number of concussions has been documented well. Girls' sports that have the highest rate of concussions are: soccer, lacrosse, ice hockey, field hockey and basketball (Rose et al., 2015). Boys sports that have the highest rate of concussion are: football, ice hockey, lacrosse and wrestling (Rose et al., 2015).

Tools

There are a number of tools available to aid the average bystander, coach or health professional in identifying patients or athletes at risk for concussion. One tool is the SCAT3 that is widely used by first responders and health officials during competitive play (Chin, Nelson, Barr, McCrory, & McCrea, 2016; McCrory et al., 2013). This tool is considered a Standardized Assessment of Concussion and is designed to be used to assess concussion symptoms through evaluation of orientation, concentration, immediate and delayed memory; scores can also help determine severity of injury and even estimate length of recovery (Chin et al., 2016; McCrory et al., 2013; Rose et al., 2015). Ideally the SCAT3 was designed to be administered before concussions occurred as a baseline test, it has yet to be recommended as beneficial in the pre-concussion time (Chin et al., 2016). Another available tool is used pre- and post-concussion as an aid in diagnosis of concussion and determination of severity, is the ImPACT test. ImPACT testing is one of a few other types of neurocognitive testing that measures areas of memory, attention, reaction time, processing speed, psychomotor speed and fine motor coordination (Resch et al., 2013). This test is ideally used as a preseason requirement for contact sports so

that quantifiable score after injury can be compared to the baseline score when an athlete is determined ready to return to play (RTP). The scores can be skewed by external and internal factors such as drugs, diseases, mood or level of alertness (Resch et al., 2013). Even with skewed data, it is observed as a helpful tool in determining the level of recovery in the athlete undergoing RTP process.

Symptoms

Manifestations of concussion can include a variety of symptoms. Most have a common core of symptoms, such as: headache, dizziness, blurred vision, and fatigue (Carney et al., 2014; Halstead, Walter, The Council on Sports Medicine and Fitness, 2010; McCrory et al., 2013; Rose et al., 2015). When these symptoms arise following any head injury, a concussion diagnosis can be expected. Other symptoms typically arise within moments of the injury and can persist weeks or months later (Leddy et al., 2015). They include continued headaches (HA), vertigo, nausea or vomiting, disorientation, visual disturbances, fatigue, confusion or impaired memory, impaired learning or concentration (CDCa, 2016). These symptoms can manifest in any number of arrangements, and sometimes may not be present until a few days after the initial injury (CDCa, 2016). Lingering symptoms of headache (HA) and dizziness have been linked to the need for further management via rehabilitation therapy (Gurley, Hujsak, & Kelly, 2013).

Treatment Problem

Most clients with concussion recover within 10 days of the injury, yet children have been shown to have delayed recovery that necessitates a longer period of management (Fineblit, Selci, Loewen, Ellis, & Russell, 2016; Rose et al., 2015). Since the Zurich 2012 report, current recommendations have emerged that are a combination of the report and limited evidence-based

research. These varied and limited recommendations have provided minimal aid in the individualization of treatments that has become increasingly necessary (Wells et al., 2015). Currently, blanket statements of compete rest for up to a week are commonly prescribed for children following a concussion (Silverberg & Iverson, 2013). For many children this is a difficult therapy to achieve complete adherence. A child or teen that is recommended absolute rest until symptom free is unrealistic (K. J. Schneider et al., 2013). One study found that most pediatric clients will recover from a concussion within a few days and be cleared for full participation in sports in 10-14 days (Wells et al., 2015). But the mean duration of symptoms until full recovery for most pediatric patients was about three or more weeks (Wells et al., 2015). Given the evidence of three or more weeks for recovery, it is unrealistic to tell a pediatric client that absolute rest is the only option for treatment. If a clinician were to institute this regimen, the pediatric client would potentially miss over a week of school and unable to participate in daily activities and physical activity for months (Wells et al., 2015). Strict rest has been researched, but is lacking in any conclusive evidence to make recommendations. Wells, et al. (2015) found in the literature that concussions in pediatric patients can produce worse symptoms and outcomes with strict rest. Many of the symptoms and behavioral problems that were identified were a result of missed school and social isolation that can exacerbate mood dysregulation in pediatric patients (Wells et al., 2015).

Exercise has been shown to increase neuroplasticity, even aid in neurogenesis, improve sleep quality, improve self-esteem, and improve cognitive function (K. J. Schneider et al., 2013). One test has shown promise for the older athlete. The Buffalo Concussion Treadmill Test (BCTT), is a function test to discriminate between concussion and other diagnoses such as depression,

cervical injury or HA and at the same time illuminate physiologic dysfunction that arises from concussions (Leddy, Hinds, Sirica, & Willer, 2016). The end results are that prolonged rest is not proving to help or speed recovery from a concussion, and depending on the severity of the injury, rest beyond the first few days may hinder recovery (Leddy et al., 2016).

In contrast to strict rest therapy, there has been a push to provide generally accepted recommendations that allow for individualized approach that involves both rest and exercise in the athletic patient and even in the nonathletic patient (Wells et al., 2015). It is also recommended that the PCP continually remind families that a full and complete recovery is expected (Rose et al., 2015).This point can be made during the close follow up that is recommended from clinicians to clients as they work to RTP. The PCPs manage and address symptoms when a concussion occurs and recommend therapy and return to school guidelines; so all in all, the PCP plays a vital role in the overall management of the pediatric concussion.

Local Problem

This project was developed in Minnesota (MN), the following section provides detail about this area. In high school athletes, the amount of concussion injuries is on the rise from 0.12 per 1000 in 1997-1998 to 0.49 per 1000 during the 2007-2008 academic year (Stache et al., 2016). This has led to an increased emphasis on awareness surrounding concussion diagnosis and prevention and treatment. Legislation, The Youth Sports Concussion Act of 2013, has been passed in all 50 states that mandates federal laws concerning the reduction of concussions and TBIs in youth sports (Stache et al., 2016)(CDCb, 2016). Minnesota has passed a law in 2011 that requires the MN State High School League to provide information on concussions, including prevention, recognizing symptoms and effects of concussions (Dugan, Seymour, Roesler,

Glover, & Kinde, 2014). The law makes sure that all coaches receive training in how to recognize a concussion and to be sure to sit the player out when a concussion is suspected. This was in response to national legislation and current data trends that emphasize a rise in concussion rates in adolescents. With growing concern over long-term outcomes, there has been an increased collection of data and analysis to help guide treatment and better prevent concussion in this population.

In MN there is an estimated total of 10,800 concussions per year (Dugan et al., 2014). Of the concussions that are treated in ED's or other in-patient settings, 43% are a result of sports or recreational activity as previously mentioned (Centers for Disease Control and Prevention, 2011; Dugan et al., 2014). Added concern is that MN has similar, yet slightly higher, number of concussion at each high school per year, when compared with national statistics. In MN the average high school has 22 concussions per year and the national average is 19 concussion per high school (Dugan et al., 2014). In a review of data from the 2013-2014 academic year, the largest percentage of concussions results from football, in MN (Dugan et al., 2014). Yet, as confirmed in national data, the highest rate of concussion is among girls, and in MN girls soccer has the most concussions at 67 or 9% of total report (Dugan et al., 2014). This is followed by girls ice hockey and then basketball (Dugan et al., 2014). In boys, football at 42% of total reports, followed by hockey (8%) and wrestling (5%) were the highest amount of reported concussions (Dugan et al., 2014).

Significance to Advanced Practice Nursing

Data implies that concussions are part of pediatric practice, across the United States (US). Identifying and assessing symptoms, performing physical examinations and recommending

treatment are paramount to pediatric health. As advanced practice nurses are becoming more mainstream and utilized in many pediatric settings, the approach to pediatric concussion management is important to consider. In many states, advanced practice nurses (APRN) have full prescriptive authority and the ability to practice to the full extent of their license. In the state of MN, APRN's have full independent authority and full prescriptive authority under the MN Board of Nursing (BON), so long as they maintain certification and practice 2080 hours under the guidance of a physician or hospital network (Minnesota Board of Nursing, 2015). This means that an APRN, has a high responsibility to accurately diagnose and recommend proper care with follow up to the pediatric concussed patient. In many settings there will be no over-sight in this situation from a medical doctor (MD). In rural settings the APRN will have to understand the dynamics of the pediatric concussed patient and understand current recommendations and then apply them appropriately to ensure best outcomes. In many situations this involves referrals for further therapy, including vestibular rehabilitation for dizziness and balance disturbances that are lingering beyond accepted length of symptoms, around 2-3 weeks (Gurley et al., 2013; K. J. Schneider et al., 2013). Without relying on a supervising MD, the APRN must be able to manage pediatric concussions and make critical decisions on when to watch, recommend rest, send for referral or even send emergently to the ED. A CPG would benefit an APRN in this setting.

Purpose

The purpose of this DNP project was to identify current evidence-based recommends for pediatric concussion patients. The goal and aim of this DNP project were to take that evidence and synthesize a congruent and succinct guideline to implement into pediatric primary care clinical settings. The CPG is meant to be a reference and guideline to aid in the management of

pediatric concussion clients. The intended audience is pediatric PCPs in a clinic setting. The CPG includes evidence-based recommendations for rest following a concussion, return to school and return to play resource recommendations and when to refer to outside therapies. The outcome of this CPG includes the ability to have a consistent voice of treatment for pediatric concussion patients, better understanding of when to refer for therapy following a concussion, improved compliance in recommending evidence-based therapies, and improved timeline for full RTP.

Definition of Terms

Concussion

The current accepted definition for concussion is described by the Zurich 2012 Consensus statement, "a complex pathophysiological process affecting the brain, induced by biomechanical forces..., which may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an 'impulsive' force transmitted to the head" (Leddy et al., 2015; McCrory et al., 2013) (American Academy of Neurology, 2013).

Glasgow Coma Scale

A tool that can quantify and help determine the severity of a head injury depending on the response from the patient. Responses are recorded for eye movement, verbal and motor. Scores can range from 15, which is the best score to 3, which is a very poor score. Interpretation is broken down to show level of consciousness and determine severity of brain function. A score of 13-15 can be classified as a mild head injury, a score of 9-12 is classified as a moderate head injury, and a score of 8 or less is considered a severe head injury (CDCb, 2016).

Table 1: Glasgow Coma Scale

Score	Measure
	Eye Opening Response
4	Spontaneous – open and blinking at baseline
3	To verbal stimuli, or speech
2	To Pain only
1	No response
	Verbal Response
5	Oriented
4	Confused conversation
3	Inappropriate words
2	Incomprehensible speech
1	No Response
	Motor Response
6	Obeys commands with movement
5	Purposeful movement to pain stimuli
4	Withdraws to pain (decorticate posturing)
3	Flexion in response to pain (decorticate posturing)
2	Extension response to pain (decerebrate posturing)
1	No response

Adapted from: Teasdale G, Jennett B. Assessment of coma and impaired consciousness. Lancet 1974; 81-84, and CDC, 2016.

Mild Traumatic Brain Injury

Most researchers use mild traumatic brain injury (mTBI) interchangeably with concussion. For most clinicians, the term concussion is preferred because this term implies that full recovery is expected in most cases, whereas with mTBI, it is possible to have extended symptoms that can persist for years or permanently (Choe, 2016). In pediatrics, the term concussion is used to help reinforce to parents that the injury is transient and that complete recovery is expected and this can aid in the discussion of return to school and play.

Loss of Consciousness

This is defined as the inability to arouse or awaken an individual for a specific time and a lack of awareness of the surrounding environment (McCrory et al., 2013).

Amnesia

During a period of injury or stress on the brain, amnesia is either the temporary or permanent loss of the ability to remember the offending. This inability to remember the incident is referred to as post-traumatic amnesia (PCA). This was once considered a standard symptom of concussion, but recent evidence suggests that this symptom occurs to a lesser extent than anticipated at about 25-30% of concussions (Dikmen, Machamer, Fann, & Temkin, 2010).

Neuropsychological Test

A term used to describe a number of tests that provide rapid empirical evidence to aid in concussion management via a battery of assessments. One of the most popular tests is the ImPACT test that measures attention, memory, reaction time and information-processing speed (Resch et al., 2013). During this assessment word recall, symbol matching, and other tests will be measured and the score can be compared to a baseline test that athletes are encouraged to obtain prior to contact sport participation (Resch et al., 2013).

CT Scan

A computerized tomography scan (CT scan) uses computers to produce and combine cross-sections of x-ray images (Talavage et al., 2016). This is useful in assessing bones, blood vessels and other soft tissues in the body that give the clinician a more detailed look than a single view x-ray (Talavage et al., 2016).

MRI

A magnetic resonance image (MRI) is a medical diagnostic imaging tool that uses a magnetic field and radio wave pulses to produce images of organs and other tissues (Talavage et al., 2016). This is especially useful for assessing damage to the brain following a concussion, as there are variations of this tool. One variation is the functional MRI (fMRI) that images the brain cerebral blood flow and measure brain activity (Talavage et al., 2016).

Second Impact Syndrome

Second impact syndrome (SIS) is a catastrophic result of an injury to the brain, when the brain is still symptomatic from an initial concussion (McLendon, Kralik, Grayson, & Golomb, 2016). During this secondary injury, severe cerebral swelling can result and be life threatening. A recent literature review article found that most serious outcomes from SIS are associated with younger age, male athlete and playing football (McLendon et al., 2016). It is also important to note that secondary injuries need not be severe to induce SIS, and the range of impacts causing SIS can happen from a few days to up to four weeks following initial injury (McLendon et al., 2016).

Post-Concussion Syndrome

This term, post-concussion syndrome (PCS), is applied to clients that have lingering concussion symptoms, HA, dizziness and balance problems, for over three weeks (Willer & Leddy, 2006). PCS symptoms can linger for months to years and they can range from physical symptoms to emotional or cognitive symptoms (Willer & Leddy, 2006). Clients with PCS need advanced rest and therapy beyond usual concussion treatments and sometimes even medication for cognitive impairment or therapy for behavioral impairment (Willer & Leddy, 2006).

Return to Play

Return to play (RTP), is a phrase used to sum up the recommended steps for a client to return to full participation into previous activities (CDCa, 2016). As will be mentioned later, there are steps that are to be followed to ensure the concussed client is not returning back to contact sport participation too soon. One rationale for a stepwise approach is to prevent SIS, as mentioned above.

Conclusion

This chapter provided an introduction and overview of pediatric concussions, including a discussion of incidence, brief pathogenesis and treatment. In addition, this chapter discussed the significance of pediatric concussions to advanced practice nursing, including identification of a local problem. The purpose of this DNP project was stated and definitions of relevant terms were discussed.

CHAPTER II: BACKGROUND

Introduction

The second chapter of this DNP project will elaborate on the previous chapter that provided an overview of pediatric concussions. This chapter will include an overview of the literature regarding pathophysiology, manifestations and treatment recommendations for pediatric concussions. It will conclude with treatment recommendations based on the literature and evidence for pediatric concussions.

Search Strategy of Literature Review

Multiple literature review searches were completed using credible search engines including: PubMed, CINAHL, Google Scholar and Cochrane Library. The search criteria were based on recommendations for most current and up-to-date evidence in literature to include articles and text that were published within the last five years, written in English and were based on human research. Search terms were specific to this DNP project. The most common terms used were "pediatric concussion" and "concussion management." These terms were also paired with other search terms including: clinical practice guidelines, treatment, symptoms, epidemiology, primary care, mild traumatic brain injury, second impact syndrome, sport concussion and pediatric. Additional literature was obtained via specific search criteria on the search engines listed above, such as vestibular rehabilitation, to gain supporting evidence.

Pathophysiology

Injury to the Brain

Shortly after injury, the concussed person's brain undergoes a complex cascade of metabolic dysfunction. Mechanical injury that is likely strain on the neurons, causes a massive

efflux of potassium from the neuron; this extracellular potassium creates an excitatory feedback signal to other cells and causes release of glutamate (Choe, 2016). The glutamate and extracellular potassium further exacerbates the neuron dysfunction by causing a continual release of more potassium as the sodium and potassium pumps in the cellular membrane are depolarized (Choe, 2016). In order to restore the balance, the cell uses adenosine triphosphate (ATP), to restore the sodium and potassium intra and extracellularly. There is an energy crisis at this point. As the cell mitochondria struggle to produce ATP for the dependent sodium and potassium pump, the brain burns a significant amount of energy and glycolysis is triggered (Choe, 2016). It is reported that excited neurons and the effects of glutamate release are responsible for up to 80% of the cerebral basal energy metabolism (Choe, 2016; Shrey, Griesbach, & Giza, 2011). With increasing extracellular potassium, calcium ions influx and cause oxidative damage to the already stressed mitochondria (Choe, 2016)

After the initial injury and the cellular dysfunction with ensuing energy crisis, there are other changes that take place. Under normal circumstances cerebral blood flow (CBF) is constant and responsive to carbon dioxide (CO_2) levels in the blood (Choe, 2016). The concussion injury disrupts the autonomic regulation of CO_2 and there is also a decrease in CBF following the injury (Choe, 2016). The CBF affects the resultant energy demand and delays recovery and is responsible for a number of potential symptoms following a concussion, such as headaches (Choe, 2016; Shrey et al., 2011). Most data on the above was obtained from injury investigational studies that are done in non-human subjects, which is not always the best way to translate damage to a human brain.

Symptoms

Discussion has been done on symptoms in the previous chapter. The most common, HA, dizziness and fatigue can be traced to the root with understanding the pathophysiology following a concussion. With energy crisis and decreased CBF, all three most common symptoms can be accounted for. As the energy crisis is managed over the immediate and acute post-concussion period, balance is restored to ionic dysfunction and symptoms typically resolve within 7-10 days (Choe, 2016; Iverson & Gioia, 2016; Rose et al., 2015). Symptoms that persist, need further management beyond what is currently recommended and will be discussed at a later point.

Imaging

Imaging a brain or skull following a head injury has been used to improve outcomes and reduce serious consequences of bleeding into the cranium, fractures of the skull or other injuries of that nature. But recent data suggest the risk of serious injury, or clinically important TBI in children is very low (PECARN, 2016). According to the PECARN Pediatric Head Trauma Algorithm used in ED settings, a CT is recommended with associated symptoms and a GCS of 14 or lower, even though the risk of TBI was 4.4% or lower (PECARN, 2016). The goal of a tool like that is to reduce the overall incidence of unnecessary imaging that could have its own detrimental effects on the developing brain. The CDC, recommends a CT scan when there is a known head injury and the patient is under two years, or over two with altered mental status or signs of basilar skull fracture (CDCb, 2016; PECARN, 2016).

Advancements in neuroimaging are being investigated to assess the structures and function of the brain following a concussion. Using a fMRI scan, there have been changes shown in patients' neuronal network connectivity that is responsible for cognition while at rest (Talavage

et al., 2016). This test has also shown changes in the brain activity of task related memory disruptions, and some patients are clinically asymptomatic, yet the fMRI is reporting there is still cerebral dysfunction (Talavage et al., 2016). There are newer scans, called diffusion tensor imaging (DFI) where results vary too much to be used as conclusive data, yet show promise in the field of identifying microscopic changes to the white matter after a concussion (Talavage et al., 2016). Using fMRI, is becoming an important component in the upcoming research, as it will give researchers concrete data to compare with physical symptoms, help aid in recommending physical rest and even aid in cognitive rehabilitation therapy (Talavage et al., 2016).

Treatment Recommendations

Rest

Rest is an important component to a healthy recovery from a concussion. Rest can be applied to the physical domain and the mental or cognitive domain. With physical rest, it is best to avoid all strenuous activity, elevation of heart rate and even play (Wells et al., 2015). Any activity that causes symptoms, results in the patient being referred as symptomatic. Cognitive rest is the avoidance of mental stimulation, including televisions, computer screens, mobile phone screens, reading, and even some scholastic events at school, such as lectures (Iverson & Gioia, 2016). The pathophysiology of the brain following concussion, including the neurometabolic energy expenditure, is the basis for most prolonged recommendations for rest (Choe, 2016; Wells et al., 2015). Although research "proving" that rest actually benefits or improves outcomes and recovery is lacking (Wells et al., 2015).

Recommendations for strict and prolonged rest have routinely been anecdotal and based on a general lack of evidence to help provide other beneficial interventions (Halstead et al.,

2010; Silverberg & Iverson, 2013; Thomas, Apps, Hoffmann, McCrea, & Hammeke, 2015). Typical recommendations have been to prescribe an immediate cessation of physical and cognitive exertion and attempt to let the brain completely rest following a concussion (Thomas et al., 2015). Since the 2012 Zurich Consensus Statement, it has been recommended that up to a week of physical and cognitive rest is acceptable, especially given the fact that youth take longer to recover (Halstead et al., 2010; McCrory et al., 2013). Rest has now become a general term and many clinicians use the ambiguity to prescribe complete rest for an overly extended amount of time (Wells et al., 2015). When assessing symptoms and quantifying scores from neuropsychological testing, multiple studies have confirmed worse outcomes following prescribed elongated rest of a 5-7 days (Silverberg & Iverson, 2013; Thomas et al., 2015). Outcomes that are measured typically include symptoms associated with concussion and results from the battery of neuropsychological tests that includes memory and reaction time. As mentioned there are MRI changes to the cerebral functioning, but most patients recover from those cellular changes within 7-10 days (Choe, 2016; Wells et al., 2015). Based on this evidence, it is reasonable to extend physical rest and mental for a period of time and work back into school and physical activity after rest. One recent study compared recommending strict rest of 5 days compared with the "usual care" which was recommending about 1-2 days of rest and then return to school. In this study the strict rest group had worse outcomes when testing for post-concussive symptoms, balance problems, missed school and worse neurocognitive testing (Thomas et al., 2015). The end results are that even though there is rationale to have a period of rest, prolonged rest is not proving to help or speed recovery from a concussion; and depending on the severity of the injury, rest beyond the first few days may hinder recovery (Leddy et al.,

2016). The duration of return to school and RTP, is different for every patient and can be improved with other therapies that will be described as well.

Exercise

As mentioned earlier, exercise has been shown to increase neuroplasticity, even aid in neurogenesis, improve sleep quality, improve self-esteem, and improve cognitive function (K. J. Schneider et al., 2013). The Buffalo Concussion Treadmill Test (BCTT), is a function test to discriminate between a concussion and other diagnoses such as depression, cervical injury or HA; and at the same time the BCTT will illuminate physiologic dysfunction that may arise from a concussion (Leddy et al., 2016). During the exercise program, the athlete is to wear a heart rate monitor and then perform graded exercises that requires execution at submaximal or subsymptom threshold for a period of time (K. J. Schneider et al., 2014). Gradually over time, the program will require an increase with intensity under supervision until they are asymptomatic with exhaustive exercise (K. J. Schneider et al., 2014). Research has shown that athletes and children with exercise programs fully recover to preinjury level, and the mean time for recovery was 4.4 weeks (K. J. Schneider et al., 2014). It was also shown that lingering symptoms, for the PCS athlete, can benefit from a 2-3 week exercise program even weeks to months after the initial injury (K. J. Schneider et al., 2014). The end result with exercise programs following rest is to initiate exercise at a graded level and under supervision. This will assure that sub-symptom threshold is obtained and improve outcomes and a full recovery (Leddy et al., 2016). Currently, exercise programs are not utilized mostly due to a lack in provider awareness of availability and evidence in support of this therapy.

Return to Play

This process has been established for some time and since 2014, all 50 states have instituted laws that prevent student athletes from returning to play following a head injury without a formal evaluation by a licensed provider (National Conference of State Legislature, 2014). The CDC has developed guidelines to follow when the provider is seeking to reintroduce the athlete to physical activity and this process is called Return to Play as defined above. There are five steps and each step is designed to be performed until symptom free at that step. The athlete must remain for at least 24 hours on each step. If symptoms present during a step or prevent further progression, a step down approach may be necessary. The steps are developed to help aid in safely returning to play (Halstead et al., 2010)(CDCa, 2016). The graded steps are listed in the table below.

Table 2: Gradual Return to Play Plan

Step	Activity level
1	No physical activity
2	Low levels of physical activity. This includes walking, light jogging, light stationary biking, light weightlifting (lower-weight, higher reps, no bench, no squat).
3	Moderate levels of physical activity with body/head movement. This includes moderate jogging, brief running, moderate-intensity stationary biking, moderate-intensity weightlifting (reduced time and/or reduced weight from your typical routine).
4	Heavy non-contact physical activity. This includes sprinting/running, high-intensity stationary biking, regular weightlifting routine, non-contact sport-specific drills (in 3 planes of movement).
5	Full contact in controlled practice.
6	Full contact in game play.

(CDCa, 2016)

Return to School

Concussions in the student can cause physical symptoms, such as HA and fatigue, and cognitive problems that make optimal school performance a challenge (Iverson & Gioia, 2016). According to one meta-analysis of post-concussive symptoms, many patients experienced symptom resolution within one week, while other symptoms can take longer, even up to 4 weeks to fully recover (Gioia, 2016). This presents a problem for the concussed patient that is attempting to continue with school work. As mentioned before, when patients are kept from social and academic situations with prescribed strict rest, there are worse outcomes (Thomas et al., 2015). The challenge for clinicians lies in the balance of determining the severity of the injury and recommending an appropriate amount of rest and then recommending the right and most effective return to school regimen (Iverson & Gioia, 2016). Symptoms associated with school difficulties following a concussion are attention problems, comprehension of topics, slowed performance in task completion, along with physical symptoms of HA and fatigue that interfere with the students ability to learn (Iverson & Gioia, 2016). One study created, at a systems level, the foundation for successful reintegration of school following a concussion (Gioia, 2016). They concluded that the educational infrastructure needed to support these students include five components: (1) setting up a concussion management team that is trained in this area, (2) medical and school systems continue education on concussion management, (3) "identification, assessment, and progress monitoring protocols", (4) interventional steps to assure successful recovery and meeting of student needs, and (5) protocols that facilitate clear and active communication between the medical, family and school systems (Gioia, 2016; Iverson & Gioia, 2016). The return to school process is not widely used at this point in time. Most providers

write a note stating the student had a concussion and that is the extent of return to school instructions. Implementing a return to school with accommodations recommendation would be a more individualized approach (Iverson & Gioia, 2016). Gioia et al. (2014), made recommendations for accommodations for the student following a concussion based on symptoms and reasonable solutions to keep the student engaged, yet able to participate as able without aggravating symptoms. These accommodations are listed in Appendix A. Some of the most commonly needed accommodations based on prevalent symptoms include: extra time for completing assignments due to impaired processing speed and memory retention, rest breaks during classes due to cognitive fatigue and headaches, and reduced stressors/stimulation at school due to irritability and symptom aggravation (Iverson & Gioia, 2016).

The authors also suggest a graded return to school as a mirror of the accepted approach for RTP as mentioned in Table 2. The goal is to successfully pass each stage by meeting the criteria as set forth by the authors. As the body and brain recovery, a gradual and graded reintegration with accommodations, will minimize symptom expression. Yet if symptoms are present or persist, then the graded return pathway provides a more detailed way to manage and step down to a lower stage until the student can successful meet the criteria. It has the same fundamental approach as RTP (Gioia, 2016). The graded return to school approach is listed in Appendix B.

As noted with other therapeutic recommendations, evidence-based guidelines on how to best integrate the concussed patient into the academic situation are lacking (Iverson & Gioia, 2016). The approach taken by many clinicians is to avoid school until clear of symptoms or return without listing accommodations and the student may struggle either way. The approach

proposed above may aid in the successful recovery of the student to perform at the same preinjury level, if it were consistently utilized by providers.

Another source that is available to aid the clinician in proving therapeutic school accommodations for the student following a concussion is the CDC. They have created the Acute Concussion Evaluation (ACE) Care Plan, (2012), where the clinician can check off symptoms and accommodations for the student to follow when they return to school. On this ACE care plan the RTP guidelines are listed for reference for families, patients, coaches, and everyone involved with managing the concussed patient. The RTP will remind those involved of the steps needed to prevent premature introduction into sporting events (Gioia & Collins, 2012). The entire ACE Care Plan is listed in appendix C. In order to minimize worsening outcomes, instituting academic accommodations is an important part of returning to school to maximize a full and successful recovery (Gioia & Collins, 2012; Iverson & Gioia, 2016).

At this time, research into the effectiveness of these graded return to school regimens is necessary, along with material for educating families about the processes to aid the student in school (Iverson & Gioia, 2016). Even though these current accommodations are based on available research, the benefits of the graded return to school regimens vs no graded return or accommodations is lacking (Gioia, 2016). In addition to a lack research, other barriers to implementing these options are unawareness of its availability and a lack of professional development for concussion management (Gioia, 2016).

Long Term Therapy

Long term therapy for the concussed patient is aimed at preventing worsening symptoms of concussion and improving symptoms that have not dissipated following a medical clearance

or referral for therapy. The most common form of long term therapy is physical therapy (PT). In PT, the provider can help with exercises and strength training and can clear an athlete to return to play. With a combined approach to the medical evaluation, many concussion patients experience a full and fast recovery (Gurley et al., 2013). Yet many providers are unaware of when a patient requires this type of therapy (Gurley et al., 2013).

Vestibular rehabilitation is one therapeutic regimen for the concussed patient. This therapy has been proven to be most effective for the concussed patient that is suffering from continuing symptoms of HA, dizziness and balance problems that have not dissipated in the first week (Gurley et al., 2013). The goal is to provide exercise for the patient, balance training via exercises. It is important to note that Benign Paroxysmal Positional Vertigo (BPPV) is a common post-traumatic symptom that can delay recovery in many patients, but must be managed prior to starting exercises for strength and exertion testing so that results are not skewed or the patient does not further injure themselves (Gurley et al., 2013).

Gaze stabilization therapy is along the same pathway as vestibular rehabilitation and research proving its effectiveness is lacking. Although some authors point out that with gaze stabilization therapy, patients are quicker to progress through balance stabilization therapy exercises (Gurley et al., 2013; Schubert, Santina, & Shelhamer, 2008).

Individual Approach

There is increased emphasis on the right amount of rest and timing for youth to return to play and return to school. The research is compelling that too much rest can be detrimental to health and social well-being (Stache et al., 2016; Wells et al., 2015). Now the research must continue to fine tune what might be the best recommendations in specific situations. As Wells et

al. (2015) mentions, providers need to be taking an individualized approach to concussion recovery. With this knowledge, there are some gaps in the literature. Specifically, when it comes to pediatric research, there is an absence of evidence-based recommendations. Many studies point to the lack of randomization in clinical trials, no duration of rest guidelines for specific points of recovery in the many post-concussion phases, no specific relevant and realistic diagnostic tools or biomarkers to help guide therapy in the concussed patient, and no medication recommendation use during the concussion phases that have been thoroughly reviewed (Wells et al., 2015). There is an immediate need to address these issues and communicate that knowledge to clinicians so that concussion patients are reliably treated and ensured the best recovery (Wells et al., 2015). It is currently expected that the next Zurich Consensus Statement meeting will more thoroughly address timing of rest and the role of exercise and neurocognitive testing in youth and adult concussions (Wells et al., 2015). In the meantime, the current state of therapeutic concussion recovery is widely varied. Rest is often prolonged, exercise and other therapies are often not recommended due to a lack of knowledge, and tools already available for school reintroduction are not utilized.

Conclusion

In this chapter the literature surrounding current recommendations for pediatric concussion patients was reviewed, with an explanation of search strategy. Pathophysiology was explained to aid in understanding of therapeutic recommendations and current tools for recovery were discussed. Lastly, this chapter has presented an evidence-based rationale which was added to a comprehensive framework for the establishment of the CPG.

CHAPTER III: METHODS

Introduction

Chapter three of this project will tie together the previous evidence presented in chapter one and two, in order to show the need for a CPG. The CPG is aimed at pediatric PCP's in order to help them recognize more severe head injury symptoms, when to recommend rest, and identify tools to aid the reintroduction into school and activities. The CPG will also recommend when to refer for follow up therapy or additional evaluation.

This chapter will also introduce the Appraisal of Guidelines for Research & Evaluation II (AGEE II) framework that was created to systematically direct guideline development, assess the effectiveness of clinical guidelines and provide instruction on what and how information should be presented in the guidelines (Brouwers et al., 2010). It will describe each domain of the AGREE II framework and relation to this project. A clinical practice guideline was then be developed to correspond with the AGREE II framework.

Need for Clinical Practice Guidelines and Education

According to the 2012 Zurich Consensus Statement, typical acute concussion symptoms resolve within 7-10 days following injury, and youth may take a longer period of time to recover from acute symptoms (McCrory et al., 2013). Given this information, trials of complete cognitive and physical rest have been rationalized, at times for periods of up to two weeks, due to the complex neurometabolic cascade described in chapter II that typically resolves around two weeks (Brown et al., 2014; Choe, 2016). Per the Zurich Consensus Statement, some researchers have made recommendations for rest until asymptomatic and again, this process can as well last for about two weeks (Silverberg & Iverson, 2013). One scientific review of the evidence showed

that there is no evidence for complete cognitive or physical rest for any duration that has been proven to improve symptoms or outcomes (Silverberg & Iverson, 2013). It has been even shown that rest beyond the first few days can be harmful (Brown et al., 2014; Silverberg & Iverson, 2013; Thomas et al., 2015). Evidence supporting recommendations for prolonged rest is nonexistent, yet many clinicians are faced with the task of making therapeutic suggestions for recovery; and per the last current Zurich guideline, a prescription of prolonged rest is a viable option. The middle ground, of moderate rest, has been proposed by a number of literature review articles. But since most pediatric PCP's are unaware of some of the review of literature recommendations due to lack of publication and solid supportive evidence, prolonged rest is still prescribed.

Prolonged rest is prescribed in the absence of strong evidence in support of this recommendation. Another point of discussion that supports development of a CPG is the recommendation of exercise. As pointed out in chapter II, exercise immediately in the acute post-concussion period can be harmful (Choe, 2016), but a graded return to light activity and then a prescribed exercise program can improve symptoms, outcomes and even promote neuroplasticity (Choe, 2016; Wells et al., 2015). Exercise programs have been long associated with improved mood regulation as well (Fineblit et al., 2016; Wells et al., 2015). In the long term, an exercise program is essential to promote proper RTP adherence and a successful return to full activities, equal to a preinjury status (Gurley et al., 2013).

Another rationale for questioning the current state of recommendations is the idea that prolonged cognitive rest can be interpreted in many ways and can be detrimental to student success (Thomas et al., 2015). Thomas et al. (2015) found that students who were told to be

removed from school for an extended amount of time performed worse on tests that measured symptoms of PCS and neurocognitive functioning. There is the idea that as youth are kept from normal socialization, the risk for isolation and mental health concerns increase (Fineblit et al., 2016). This implies that a serious look at the evidence supporting such strict rest recommendation is necessary, especially since mental health awareness is increasing in today's medical world.

Lastly, evidence and research is beginning to show that other therapeutic modalities are improving successful recovery following concussion. One such modality is the referral for physical therapy (PT). During a visit with PT a patient will be able to have consistent follow up and progress monitoring of symptoms. A patient will have exercise programs tailored to improve balance and maintain strength during recovery. Finally, PT is able to perform exertion testing to comply with national standards, where there is a mandate to follow RTP steps (CDCb, 2016; National Conference of State Legislature, 2014).

Framework

Working Framework

The AGREE II framework was used in this project as a means to guide development of the CPG and a means to evaluate its efficacy for future implementation. When using the AGREE II framework, the author can apply the evaluation criteria to be sure the necessary content is covered in the CPG. This is one benefit to using the AGREE II framework. According to the Institute of Medicine (IOM) CPG's ideally have eight desirable attributes: validity, reliability and reproducibility, clinical applicability, clinical flexibility, clarity, documentation, multidisciplinary development and plans for review (Institute of Medicine, 1992). It has been

accepted that the AGREE II meets the criteria for the IOM and other organizations that have investment in the promotion of quality CPG's. The AGREE II framework is an updated form of the original 2003 AGREE framework. In the updated and revised version consisted of changes to improve upon and add to the refinement of the purpose, a scale for response from reviewers, and new user's manual that improves and guides the appraiser with ease as they utilize the tool and understand the terms (Brouwers et al., 2010). This tool has been used many times for appraising clinical guidelines from health care and it has been used as a framework for other purposes of developing policy-related tools and systems-level templates (Brouwers et al., 2010). The original AGREE framework had six domains and this has remained the same, although refinements to the domains have been made to each. The six domains are: Scope and purpose, Stakeholder involvement, Rigor of development, Clarity of Presentation, Applicability, and Editorial independence (Brouwers et al., 2010). Using the AGREE II framework, an appraiser of the CPG answers questions that are under each domain, and then rates the question on a scale of strongly agree (score of 7) to strongly disagree (score of 1). In this manner, the appraiser can score the CPG. The author of the CPG will compile scores and put into results the overall assessment and recommendations regarding the use of the guidelines (White & Dudley-Brown, 2012).

Scope and Purpose

In this section the overall objectives are described and any health questions that are answered via the CPG are described as well (Brouwers et al., 2010). In this section the population is also addressed (Brouwers et al., 2010). This domain sets the stage for the rationale of the CPG and its use for the pediatric PCP.

Stakeholder Involvement

This domain explains and shows that the CPG was developed with relevant professional input and guidance (Brouwers et al., 2010). It also addresses and defines the target population and describes what preferences this population might prefer (Brouwers et al., 2010). This domain is designed to show that the CPG development will involve input from professionals within an organization and the population with which it is designed to address, resulting in improved adoption.

Rigor of Development

There are eight components to this domain. Overall, this domain is set in place to assure methods, research, and scientific basis of CPG development are in place (Brouwers et al., 2010). In order to achieve this goal of the domain, the eight components must be addressed: methods for formulating recommendations; consideration of health benefits; risks and side effects; evidence that shows a direct link to recommendation; CPG is externally reviewed; procedure for updating CPG; systematic methodology for evidence retrieval; criteria for evidence inclusion and overall strengths and limitations of evidence (Brouwers et al., 2010).

Clarity of Presentation

In this domain, the CPG language, format and structure are addressed with respect to the overall clarity of the guideline (Brouwers et al., 2010). Ambiguous or unspecific recommendations are filtered out, and ideally the recommendations and supporting treatment options are evaluated on ease of identification (Brouwers et al., 2010).

Applicability

This domain addresses implementation strategies for the CPG. The CPG needs to provide advice on how to implement recommendations, describe barriers and facilitators of application, and consideration of cost or resources needed for application (Brouwers et al., 2010). This ideally should include some form of monitoring the application of the CPG to be sure that continued evaluation can be in place (Brouwers et al., 2010).

Editorial Independence

This domain address the link between funding of the CPG and development of the CPG (Brouwers et al., 2010). Ideally the CPG will demonstrate a clear distinction that funding or other conflicts of interest, did not interfere with the development (Brouwers et al., 2010).

Clinical Practice Guideline Development

Clinical practice guidelines are effective means to guide practice. CPGs can be time intensive and expensive for organizations to develop, as authors and clinical experts need to review literature and assess what recommendations need to be made (Dizon, Machingaidze, & Grimmer, 2016). Even though a relevant CPG is desired in many settings for particular problems or disease states, creation of new CPGs are a large undertaking and not always an option in many organizations due to time and resources available for construction of a new CPG (Dizon et al., 2016) (White & Dudley-Brown, 2012). Dizon et al. (2016), mention that different approaches can be taken in the development of a CPG. One method is to search the CPG databases and find one that fits the specific population of interest and adopt it as is for the organization (Dizon et al., 2016). This process is rare as many organizations have individual needs and dynamics that make complete unchanged adoption unlikely (Dizon et al., 2016). The next option would be to find a

CPG that meets many needs for the organization and population of choice and not change any of the recommendation, but contextualize the CPG for the target population and infrastructure where the CPG is to be utilized (Dizon et al., 2016). Lastly, an option is to adapt a similar CPG, but this requires permanently changing aspects of the CPG to be utilized in the desired setting (Dizon et al., 2016).

This project aims to adapt the current state of widely varied instructions, as noted in previous chapters, and to contextualize some suggestions with regard to pediatrics. As mentioned, there is a lack of evidence supporting current therapeutic rest propositions, yet following these current recommendations of would not be erroneous. There is a lack of evidence-based options for recommendations. But adapting evidence from many sources and combining other evidence-based therapies into one spot for the pediatric PCP, would be helpful when managing pediatric concussion patients.

Target User

As mentioned above, this project is a CPG focused on delivery of recommendations for pediatric PCP's. The setting for the CPG was designed to be for primary care, although the recommendations could be contextualized to be used in other settings.

Formulation of Key Action Statements

For this purpose, a model of recommendations were followed that includes all the necessary elements of the AGREE II framework. The American Academy of Pediatrics (AAP) uses a format of Key Action Statements when providing evidence-based recommendations. This is the model that was followed for the pediatric concussion CPG.

Ingrained in this model of formal recommendations from the AAP are key action statements (Steering Committee on Quality Improvement and Management, 2004). It is the purpose of the key action statements (KAS) to express the evidence quality for the recommendation, determine the level of benefit or harm for the recommendation and finally place an overall recommended grade for the statement (Steering Committee on Quality Improvement and Management, 2004). The quality of the evidence is based on the type of research that was used to support evidence, and this would be information pertinent to the AGREE II domain three, Rigor of Development. The evaluation of the level of harm or benefit to the patient is an important piece of CPG development. In order to have adoption of CPG, the benefit over harm would provide a stronger recommendation (Steering Committee on Quality Improvement and Management, 2004). This part of the KAS is in-line with the AGREE II domains: Rigor of Development and even Stakeholder Involvement. Finally, there is an alphabetical grade given to the statement that evaluates the overall evidence, harm/benefit and makes a formal recommendation that is one of the following: (A) strong recommendation, (B) recommendation, (C) option, (D) no recommendation (Steering Committee on Quality Improvement and Management, 2004). See figure 1 below for guidance in the format of recommendations. All recommendations are not meant to overrule professional assessment in relation to patient specific situations (Steering Committee on Quality Improvement and Management, 2004). But if the recommendation is (A) Strong recommendation, there is little evidence contrary to not adhere to the preferred recommendation. The guidelines are meant to represent the best decision-making patterns that have been identified by a pool of experts that have researched this topic in-depth. So following the recommendations will aid in therapeutic

decision-making (Steering Committee on Quality Improvement and Management, 2004). When there is no recommendation, clinicians should feel free to make the decision for treatment based on what is best in that situation, with patient preferences included (Steering Committee on Quality Improvement and Management, 2004).

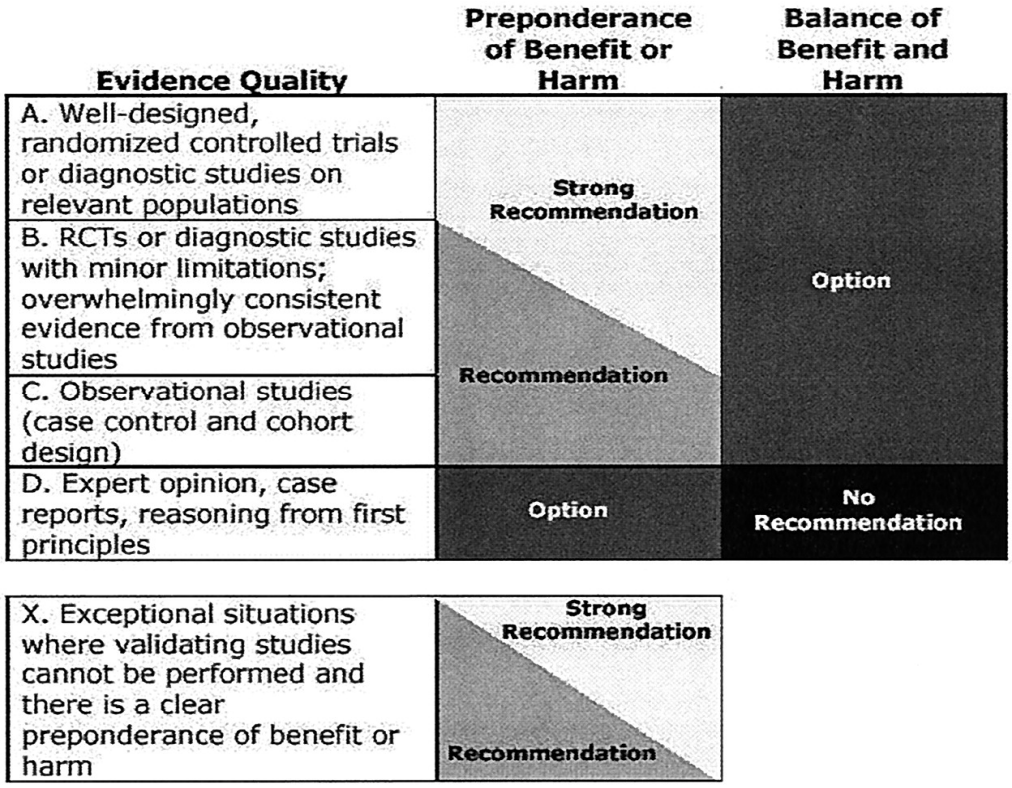

FIGURE 1: Level of Recommendation for KAS (Steering Committee on Quality Improvement and Management, 2004)

Literature Inclusion/Exclusion Criteria

The literature review process was described in chapter two.

External Review

The reviewers appraised the CPG with the AGREE II tool. The reviewers are clinical experts in pediatrics. They are both Master's prepared PNP's with over 10 years of primary clinical practice between them. Their anonymity was preserved to prevent bias when scoring the CPG. It will also be reviewed by the DNP committee of the primary author of the CPG, consisting of two DNP-prepared NPs and one PhD-prepared NP.

Clinical Practice Guideline Implementation

A CPG was created with the purpose of providing evidence-based guidance and recommendations on concussion treatment in the pediatric population. This was designed to be utilized in the pediatric PCP setting. The CPG was developed and evaluated with the AGREE II framework to guide information and content of the CPG. The design and content will be described in detail in Chapter 4.

Conclusion

This chapter reviewed and purpose and importance of CPG development for pediatric PCPs that treat concussion patients. The conceptual framework was introduced and explained, along with the working framework that will guide the content of the CPG. The AGREE II framework was described in relation to the population of interest. The framework was broken down to describe the target population, key action statement purpose and design, literature review, and reviewers of the CPG. Lastly, the implementation plan was briefly described.

CHAPTER IV: CLINICAL PRACTICE GUIDELINE

Introduction

Chapter four will showcase the concussion clinical practice guideline that was developed for use by pediatric PCPs. This chapter will start with a brief statement of the objective, the target population and then describe the CPG's key action statements. The KAS for the guideline were divided into four categories, diagnosis, prevention, treatment, referral to specialty, and further education. In each category, the KAS were described as they are set up. This includes discussion on the evidence summary: quality of evidence, benefit of the statement, harm, cost, benefit to harm assessment, value judgements, intentional vagueness, role of patient preferences and any exclusions that are necessary (Steering Committee on Quality Improvement and Management, 2004).

Objective

The primary objective of the following CPG is to provide pediatric PCPs with an evidence-based guide for the management of pediatric concussions. It will also introduce evidence-based rationale for specialty referral for concussions in children. A secondary objective is to reduce the likelihood of long-term complications and improve quality of life for children and families following a concussion.

Population

The CPG that follows is intended for use in the management of pediatric patients, ages 0-18 years old, male and female, who are treated by pediatric PCPs in a primary care setting. PCPs in the pediatric setting include physicians, nurse practitioners, and physician assistants who care for pediatric patients as defined above.

Key Action Statements

Diagnosis of Pediatric Concussions

According to the definition of concussion as biomechanical forces that induce the complex pathophysiological process affecting brain functioning (McCrory et al., 2013), we can induce that following many injuries, direct or indirect, there is a possibility of some kind of traumatic brain injury. Most pediatric patients will present with classic symptoms of headaches, balance disturbances, confusion, fatigue, photophobia, or even nausea and vomiting (Halstead et al., 2010; Rose et al., 2015)(CDCb, 2016). Most clinicians have done away with scoring symptoms, as in the SCAT in the pediatric setting as these have proven to be ineffective in predicting outcomes (Giza et al., 2013). Some patients present with subconcussive symptoms, these are symptoms that present in an atypical fashion, no decreased Glasgow Coma Scale score, no amnesia and no LOC (Rose et al., 2015). Especially in pediatric patients, there is little research into subconcussive symptoms. Given this information, there is a wide variety of presentations for the pediatric head injury and possible concussion patient. With concerns over concussions and awareness of the growing problem, it is important to not overlook possible injuries and brush aside a TBI as only a "zinger" to the head (Rose et al., 2015). The goal is to recognize possible and likely symptoms of a concussion, especially following any impact that could result in injury to the brain; the provider should suspect a concussion and use clinical judgement and assessment to confirm the diagnosis (Leddy et al., 2015; Rose et al., 2015). Other symptoms may be manifestations of cervical injury or more serious TBI (Leddy et al., 2015). But with careful consideration of the history and possible injury, it is most important to have awareness of potential concussion. This awareness will aide in management of symptoms through varied

treatment options and help guide education for patients and families (Rose et al., 2015). As mentioned above, the CDC has developed the ACE Care Plan for helping clinicians in identifying symptoms, returning to school accommodations and listing return to play guidelines (Gioia & Collins, 2012). The ACE Care Plan is listed below in Appendix C. The following key action statement addresses the diagnosis of pediatric concussions.

Key Action Statement 1

Clinicians should diagnose a concussion in any child with direct or indirect head injury who presents to the primary care setting with any symptom on the CDC ACE Care Plan.

TABLE 3: Key Action Statement Profile: KAS 1

Aggregate evidence quality	Grade B
Benefits	Promotes incidence of correct diagnosis of concussion. Reduction in missed diagnosis and worsening symptoms. Increases likelihood of returning to school and/or sports sooner than a missed diagnosis.
Risks, harm, cost	No risk or harm; possible cost for training providers
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value for importance of accurate diagnosis
Intentional vagueness	"Direct or indirect" is used so that clinician may use discernment when assessing and making concussion diagnosis
Role of patient preferences	None
Exclusions	Infants
Strength	**Strong Recommendation**

Discussion

Evidence for this action statement is mostly based on observational studies that list out common symptoms experienced and have been largely been agreed upon in the literature (Gioia

& Collins, 2012; Giza et al., 2013; McCrory et al., 2013). This evidence is the main rationale for the classification as Grade B for research rigor. No studies were specifically found to support the use of the CDC Ace Care plan over others, but the comprehensive nature of the care plan, including RTP and lists for accommodations, make it a desirable tool. The remainder of the profile is important in establishing the classification grade for this action statement as well. A missed diagnosis could lead to worsening symptoms and possible second impact syndrome, which may result in further complication (McLendon et al., 2016). There are no risks or harm associated with using a certain list of symptoms, and cost of education and supplies to provide clinicians with the ACE Care Plan would be the only real cost associated with this action statement. Given that information, there is really a preponderance of benefit associated with this action statement. The value statement is high, as the risk of a missed diagnosis likely outweighs any difficulty associated with integration of this care plan. Lastly, the only exclusion would be infants, as the symptoms would be difficult to associate and likely history of injury is most important in diagnosis of head injuries in this age group (Rose et al., 2015).

Prevention of Pediatric Concussions

One of the most important aspects of pediatric concussion management is prevention and education. With proper education about concussions, patients and families can make informed decisions about risks associated with playing certain sporting activities (Rose et al., 2015). Quality of life is another aspect involved in education about concussions, as most youth have therapeutic enjoyment to engage in sports, and others cite the main motivating factor as provision of worth, monetary gain or other (Fineblit et al., 2016). With any choice, there has to be some role of the pediatric PCP to engage in discussion regarding prevention of injury and

concussion. The main aspect of prevention is education about protective equipment available and education on the proper techniques for playing a particular sport. The following action statement addresses the prevention of concussions that is mainly within the scope of discussion for a PCP. Other statements about proper techniques with playing sports would lie within the coaching or health trainer scope of discussion.

Key Action Statement 2

Clinicians should recommend proper safety equipment for playing sports and educate patients and families on its importance.

TABLE 4: Key Action Statement Profile: KAS 2

Aggregate evidence quality	Grade C
Benefits	Promotes ownership in safety training for the child. Prevents injuries and decreases chances for concussions.
Risks, harm, cost	No risk or harm; possible cost of time when providing education for the child/teen athlete
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value in prevention of injury and promotion of safety
Intentional vagueness	No specific types of safety equipment mentioned, so clinicians can tailor information to specific activities
Role of patient preferences	Limited to what the patient is willing to wear and what is required by the sporting laws
Exclusions	None
Strength	Recommendation

Discussion

Evidence for this key action statement is lacking in recommendation for a general population. There is a lack of prospective randomized controlled trials and most evidence is gathered from observational studies (D. K. Schneider et al., 2016). The classification for this

action statement has been given a Grade C, recommendation. Although the evidence is not as strong as would be preferred for a key action statement, there is still desire to protect youth as much a possible if they are going to participate in sporting activities. There have been a number of methods proposed from organizations to promote prevention of concussions, such as the HeadsUP program from the CDC (CDCa, 2016). Some of the aims of many educational programs discuss the importance of proper gear and realization that the initial intent of much of the protective equipment is designed to prevent superficial injuries and not prevent concussions (D. K. Schneider et al., 2016). Even with this education into the schools and coaching realms, concussions are still on the rise (Centers for Disease Control and Prevention, 2011; Rose et al., 2015). Even more disturbing are the statistics that 25% of high school concussions result from aggressive or illegal play (Centers for Disease Control and Prevention, n.d.) (CDCa, 2016). This stresses the importance of education with an emphasis on protection, as a means of prevention of concussion.

Currently, the key action statement classification Grade C is largely based on a systematic review of existing research on prospective and observational studies. In all, the research is lacking in prospective studies as mentioned (D. K. Schneider et al., 2016). Important research in guiding the role of equipment in prevention of concussions have looked at helmets, mouth guards, face masks and other padding (D. K. Schneider et al., 2016). Overall, this equipment prevented superficial injuries but provided suboptimal protection from concussions (D. K. Schneider et al., 2016). One study in particular looked at 1300 high school football players and found that regardless of brand or model of helmet use, concussion risk did not change (McGuine, Hetzel, McCrea, & Brooks, 2014). Furthermore, they expound by saying that the current helmets

offer nothing in protection from concussions because the helmets do not prevent movement of the brain within the cranium vault (McGuine et al., 2014). This begs the question that prevention will not only focus on equipment in the future because it shows that we have likely reached, or are close to, the threshold of protection from helmets and the likely solution to the rise of youth concussions lies in multidisciplinary approach (McGuine et al., 2014; D. K. Schneider et al., 2016). Even with this information, Schneider et al. (2016) provide information the at relative risk of concussion with standard equipment at 0.82 compared to those with no equipment and also with use of interventional equipment, such as full face shields in ice hockey and bicycle helmets, the relative risk of concussion dropped to 0.41 when compared to those who wore standard or no equipment. This provides evidence that some equipment is protective and even though research is lacking in prospective trials, wearing no equipment is worse than just standard equipment.

The remainder of the evidence profile shows there is no added harm or risk. So the preponderance of benefit is over the potential cost of education and time needed to stress the importance of wearing protective equipment. There is also the cost of the equipment for the family, but that cost lies outside of the recommendation. The value statement puts this action statement at a high place to remind the PCP that safety is priority and even protection from superficial injury is important. As evidence supports, no specific brands of safety equipment have been mentioned and this statement is ultimately left up to the patient and family to wear and follow through with the recommendations. There are no exclusions.

Treatment of Pediatric Concussions

Care of pediatric patients following a concussion is subject to many theories and little evidence. According to the AAP and the Zurich Consensus statement, following a concussion,

the child is to be at rest until asymptotic before returning to activity, there is little to say about cognitive rest in these statements (Halstead et al., 2010; McCrory et al., 2013). Evidence surrounding the best amount of rest is lacking and varies from complete rest for a week to a few days of cognitive rest (Giza et al., 2013). Legislation in all of the US states mandate that a child athlete be cleared by a medical professional prior to return of play in sporting activities (Rose et al., 2015). The following statements will address rest in the pediatric patient and return to school. As it is unrealistic and even detrimental to restrict socialization and isolate a pediatric client, the following statements will address the proper return to school process as well.

Lastly, symptoms that linger and cause a protracted recovery following a concussion need to be addressed. There are recommended therapies that are managed by specialty care. Currently exercise therapy, as described in the previous chapter, and other therapies have shown favorable outcomes in promoting recovery from symptoms (Gurley et al., 2013; Leddy et al., 2016; Rose et al., 2015).

Key Action Statement 3a.

Clinicians should recommend no more than 1-3 days of physical and cognitive rest following a concussion diagnosis.

TABLE 5: Key Action Statement Profile: KAS 3a

Aggregate evidence quality	Grade C
Benefits	Standard recommended time to rest and then return to social activities. Promotes a realistic time of physical and mental rest. Does not set the youth up for failure by requiring unrealistic expectations and promotes reintegration to social activities.
Risks, harm, cost	Risk of continuing symptoms that may not resolve in 1-2 days, but longer rest periods are not associated with quicker symptom

	resolution; Harm, none; Cost, missed school/work for parents
Benefits-harms assessment	Preponderance of benefit over risk
Value judgements	High value in research supporting shorter rest periods and returning to social activities to promote better recovery
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Recommendation

Discussion

The evidence for this key action statement classification Grade C, is largely limited. There are few studies to support one-sized fits all recommendations, hence the Grade C and recommendation. This provides the clinician with the ability to make judgement and recommendations in light of what might be best for the individual case/patient that they are presented with (Steering Committee on Quality Improvement and Management, 2004). The research supporting this action statement comes from a few relevant studies. One randomized controlled trial (RCT), as described in the previous chapter, showed that patients who were assigned strict cognitive and physical rest of five days compared with a usual care group, of 1-3 days of cognitive and physical rest and then a gradual return to school and activities, had similar outcomes and resolution of symptoms (Rose et al., 2015; Thomas et al., 2015). Thomas et al. (2015), goes on to mention that the usual care recommendation proved to be an effective strategy to promote resolution of symptoms in youth following a concussion. They point out that the strict rest group reported more symptoms throughout the duration of the study (Thomas et al., 2015). Brown et al. (2014), performed a prospective study on pediatric concussion patients and found that increased cognitive activity directly following a concussion was associated with a longer

recovery period. This study did not make a distinction with showing moderate to light cognitive activity and recovery of concussion (Rose et al., 2015; Thomas et al., 2015). This supports a recommendation that moderate physical and cognitive rest for a period of at least one day and no more than 3 days will provide a sufficient time for immediate recovery. Extreme rest can hinder recovery and even promote mood dysregulation and prolonged symptoms (Leddy et al., 2016; Wells et al., 2015).

The research rigor is limited by the number of quality studies to support this action statement, as most articles point out. The overall benefit is a preponderance over potential risks. The risks are mostly associated with initiation of activity too soon and symptoms that do not resolve within the first few days. Those situations will be addressed in a later KAS. There are no harms associated with this recommendations, as the return to play guideline is still in effect. The cost associated with this action statement is missed school for students and work for parents. Evidence supports a strong social reintegration as discussed in the previous chapter, and so there is a high value in promotion of a faster recovery with less symptom presentations. There are no exclusions to this key action statement.

Key Action Statement 3b.

Clinicians should fill out and use CDC ACE Care Plan for school accommodations when concussed children are returning to school.

TABLE 6: Key Action Statement Profile: KAS 3b

Aggregate evidence quality	**Grade C**
Benefits	Reduction in missed school and social integration by providing accommodations. To promote better resolution of symptoms,

	accommodations will allow for the student to remain in class. Prevents protracted recovery when students feel isolated. Promotes further communication between educators and clinicians to discuss progress and symptoms.
Risks, harm, cost	No risk or harm; possible cost of paper and time for filling out form
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value placed on the importance a standard accommodation form and returning to school as soon as possible
Intentional vagueness	None
Role of patient preferences	Form can be modified and selected to best suit the patient's needs
Exclusions	Non-school-aged patients
Strength	Recommendation

Discussion

The evidence supports returning to social activities sooner (Thomas et al., 2015). Physical rest is still important, but returning to school can be accomplished sooner to minimize symptoms associated with social isolation (Gioia, 2016). One prospective study showed that high school athletes may take longer to recover than others due to continuing physical symptoms (Micky Collins, Lovell, Iverson, Ide, & Maroon, 2006). This study found that symptoms can sometimes take up to 4 weeks for complete resolution (Micky Collins et al., 2006). It is unrealistic to recommend rest for that period of time and the amount of school missed would have a significant impact on the recovering student athlete (Gioia, 2016). The research rigor of this action statement is lacking and limited to expert opinion, as there are no studies showing the benefit of school accommodations over none (Gioia, 2016). But models have been proposed and further research is needed. That is why this action statement is classified with a Grade C, recommended. Again the benefit lies in the awareness of the recommendation and then tailoring the approach of

the necessary accommodations as needed. Research shows that physical symptoms can be detrimental on school performance (Thomas et al., 2015; Wells et al., 2015). It is logical to return to school once acute symptoms resolve and then provide accommodations to promote the best return and likely success of the student (Gioia, 2016; Iverson & Gioia, 2016).

The other aspects of the evidence summary are no harm, risk or cost and an overall preponderance of benefit over potential cost of paper for supplying the accommodations. There is a high value in returning to school and minimization of social isolation and decrease in stress from missed school and work (Iverson & Gioia, 2016). The patient preferences can be modified and tailored to meet the needs of the student. Again the CDC ACE Care Plan form was chosen, so that one visit to the PCP might provide symptom recognition from KAS 1 and then provide accommodations for this action statement. There are no exclusions, unless the youth is not school-aged.

Key Action Statement 3c.

Clinicians should refer to specialty care when patients present to the primary care setting with symptoms of HA, Dizziness and/or visual disturbances lasting longer than one week.

TABLE 7: Key Action Statement Profile: KAS 3c

Aggregate evidence quality	Grade C
Benefits	Reduction in protracted recovery. Improved return to normal activities when referred for these symptoms.
Risks, harm, cost	Risk of referral when symptoms are within normal limits; no harm; Cost of referral and specialty care, deductible cost and insurance coverage variability
Benefits-harms assessment	Preponderance of benefit over risk

Value judgements	Early specialty care for sustained symptoms to promote better symptom resolution
Intentional vagueness	No specific type of care noted
Role of patient preferences	Limited to what patient and family are willing to participate in and what benefits they perceive
Exclusions	None
Strength	Recommendation

Discussion

Evidence for this statement is based on prospective and observational studies. This key action statement has been classified as Grade C, based on the research rigor. This grade will also provide the clinician with options to make the best individual recommendation. Some factors that will need to be considered are gender, as high school aged females tend to have longer recovery following concussions and previous concussions predispose a patient to more risks and a longer recovery (Gurley et al., 2013; Ponsford et al., 2012). These are examples of factors that the clinician will utilize when determining the necessity of specialty care, along with lingering symptoms as mentioned in the statement. Some of the more common therapeutic referrals are with physical therapy and exercise therapy, as will discussed below. Individualized care is needed when decisions for neuroimaging may be necessary, such as concerns for when a fracture or intracranial hemorrhage is suspected. In other cases, the PCP may deem a referral for neurology necessary or referral to a concussion clinic (Rose et al., 2015).

According to Leddy (2016), young athletes that have symptoms beyond the acute phase, would benefit from graded exercise therapy. The benefits of exercise have been well documented in many settings, as in fatigue syndrome and stroke patients (Wells et al., 2015). The inverse has also been seen, that following a concussion, extreme rest can worsen symptoms

and even be detrimental to health by increasing social isolation, mood dysregulation and behavioral problems (Wells et al., 2015). With most sources stating that the acute cerebral malfunction phase following a concussion improving in 7-10 days, it stands to consider that any symptoms lingering beyond this point will now benefit from graded exercise and specialty care programs (Gurley et al., 2013; Leddy et al., 2016; Wells et al., 2015).

Leddy et al. (2016), saw that graded exercise programs reduced post-concussive symptoms and improved return to play status. Leddy et al. (2011) showed that under specialty care guidance, post-concussive patients recovered quicker and showed symptom improvement. The same group provided another prospective study that monitored symptoms while performing graded exercise in youth and adults and found that exercise does not worsen symptoms for all patients and tailored specialty care guidance with exercise and other therapy can aide in recovery from concussions (Baker, Freitas, Leddy, Kozlowski, & Willer, 2012; Leddy, Baker, Kozlowski, Bisson, & Willer, 2011). Gurley et al. (2013), reviewed that balance therapy and other vestibular therapy proved to improve post-concussive symptoms and reduce time to full return to play.

Risks involved with specialty care referral are limited to possible therapies that would be provided. In the case of graded exercise programs, some individuals in the prospective trials had worsening symptoms with exercise, and these were likely attributed to level of activity, underlying conditions or other factors (Baker et al., 2012; Wells et al., 2015). If the clinician is making an individualized plan, this risk will have to be considered and open dialogue with the specialty care provider will enhance recovery. There is no harm in the referral to specialty care. Lastly the added cost of referral is a consideration for the client and family. Most families and patients want to return to normal functioning and so added therapies are a welcome change from

the previous week of rest and decreased activities (Wells et al., 2015). This action statement is listed as preponderance of benefit over risk for the above reasons.

The value statement is placed high as there is a push to provide any therapies that may provide relief from symptoms and help the recovery process move along. The vagueness statement is there to remind that some offices provide physical therapy and occupational therapy and neuropsychological testing and others focus on just vestibular therapy. The clinician can make this judgement. There are no exclusions for this except the obvious no exercise therapy for infants or toddlers. In fact, younger age was one of the predictors that exercise therapy would aide in complete functional recovery (Baker et al., 2012).

Patient/Parent Education and Recommendations for Concussion Management

Education in the primary care setting is essential to patient and parent success in management of acute and chronic illnesses, diseases and injuries. Paramount to this education is to be sure that the PCP gives appropriate information about what is known and what is not known when dealing with certain topics. In the case of pediatric concussions there are some things that are unknown, as described in the previous chapters, such as: the degree and duration of adequate rest, the degree of adequate exercise, any relevant tools and biomarkers for more consistent concussion diagnosis (Wells et al., 2015). It's also important to explain what is known to the patient and family. The above key action statements are a summary of what is mostly known to help aide in the management and recovery of pediatric concussions. Next it's important to address some other aspects that are known to help in the recovery process. Namely, the CDC has had published and 50 states required written clearance from a health care professional before a child/youth can return to full play following a concussion (CDCa, 2016)

(Centers for Disease Control and Prevention, n.d.). This is information that must be shared and communicated to families. It will also strengthen the consistent voice that should be coming from pediatric PCPs (Wells et al., 2015). The next information that is becoming important to cover and education patients and families about, is the neuropsychological testing. This testing is extremely useful if done pre-injury (Rose et al., 2015). If patients and parents are unaware of this benefit, or the school that they are playing sports with do not mandate a pre-test, then it is a squandered opportunity to improve management of concussions when they occur.

Recommendation 4a.

Clinicians should discuss with patients and parents the importance of the RTP steps and of the need for written clearance prior to full participation in sports.

TABLE 8: Key Action Statement Profile: KAS 4a

Aggregate evidence quality	Grade B
Benefits	Standardized and formulaic steps to appropriately stress the body in levels and prevent returning to full contact sports or vigorous training too early. Prevents re-injury and promotes a safe return to full activity.
Risks, harm, cost	Risk and harm of non-compliance and return to play too soon, although written clearance is designed to assure proper RTP; cost of time and appointments for frequent training and check-ups to assess progress
Benefits-harms assessment	Preponderance of benefit over harm
Value judgements	High value placed on the importance of a set of therapeutic management criteria.
Intentional vagueness	None
Role of patient preferences	Patient able to be cleared/followed by specialty care, PCP or sports trainer
Exclusions	Children not in competitive sports or younger
Strength	**Strong Recommendation**

Discussion

In 2009, Washington state was the first state to pass a law requiring youth that have sustained a concussion to be removed from play and not able to return to play until cleared from an approved health care professional (AHCP)(Centers for Disease Control and Prevention, n.d.). Since then, versions of the same law have been passed in all 50 states (Centers for Disease Control and Prevention, n.d.). This action statement, is designed to help integrate this information into the visit with a PCP once a child or teen has had a concussion. The benefits are to highlight the importance of knowing the laws for each state and educating patients and athletes on safe practices once a concussion is suspected or confirmed by an AHCP. The evidence is for this statement is grounded in the laws from each state and all have some form of a stepwise approach to help guide the RTP protocol. The steps have been described in the previous chapter. The main overarching goal with the stepwise approach, is to see the concussed athlete or child improve activity without symptoms and ultimately get written clearance to RTP (Hollenbeck, 2016; Rose et al., 2015). Written clearance is an ambiguous term, and in many states they have left the terminology open, such as health care professional, so that many individuals can give written clearance (HHS CDC National Center for Injury Prevention and Control, 2013). Some states are finding this process as adding more confusion, because there are too many choices, whereas other states have specified who can give written clearance (HHS CDC National Center for Injury Prevention and Control, 2013). In the state of Massachusetts only a medical doctor, nurse practitioner, certified athletic trainer or neuropsychologist can give written clearance (HHS CDC National Center for Injury Prevention and Control, 2013). In the state of Minnesota (MN), written clearance can be provided by a health care professional, and

this leaves room for trainers, physical therapists and others providers to be involved in the clearance process (Hollenbeck, 2016). Whatever the process, there is a benefit of safety for having a clear process in place that protects the children and teens from further damage by removing them from play and requiring a formal written clearance process to return to game play. This is guiding benefit for this action statement.

The risks are limited, but illustrate an important point in specifying who can give written clearance. The main risk is that a coach or parent or athlete is not honest and gets clearance to return to play and causes further injury to their concussed brain. So one benefit of specification for written clearance is to avoid this risk. For example, in the state of MN the Minnesota State High School League (2011), specifies that a parent cannot authorize RTP, even if the parent is an AHCP. But coaches and other staff, are not limited in the current law, so the risk of further injury is present. The pediatric PCP plays a vital role in the education process for the patient and parent with regard to the laws surrounding the RTP process and when to be removed from play. In the end, the preponderance of benefit of education is over the risk of not providing this information to patients and parents. Patient safety is the utmost importance.

There is a high value placed on the set of standards and laws that are present to ensure patient safety. There is also a high value on following the law as a pediatric PCP. Involved in this process of abiding the law, includes the education given to families as well. If parents are aware of the current laws, then they are more likely to advocate that coaches and staff at games are current as well (HHS CDC National Center for Injury Prevention and Control, 2013). There is no intentional vagueness for this action statement. The patient preference for this action statement includes knowing who can provide written clearance for them following a concussion. It also

will encourage follow-up with multiple disciplines so that they can individualize their recovery process (Wells et al., 2015).

Recommendation 4b.

Clinicians may recommend pre- and post-injury neuropsychological testing for children/athletes that participate in sports.

TABLE 9: Key Action Statement Profile: KAS 4b

Aggregate evidence quality	Grade C
Benefits	Baseline information on neuropsychological testing can be compared with post-injury testing to aid in determining recovery status.
Risks, harm, cost	Risk of intentional poor performance on pre-test; no harm; cost of testing.
Benefits-harms assessment	Preponderance of benefit over risk
Value judgements	Value in a quantifiable score to aide in assessing recovery
Intentional vagueness	No specific testing named, there may be more than one type
Role of patient preferences	None
Exclusions	Children under 8, neuropsychological testing not made for this age range
Strength	Recommendation

Discussion

Evidence for this action statement is based on recommendations from many sources. There have been a few studies looking at the reliability and the sensitivities for certain neuropsychologic testing. One cross-sectional study measured multiple groups neuropsychological testing scores over specific time periods following concussions (Resch et al., 2013). This study and others have found that the test studied proved to more reliable when given and assessed in a pre-injury and post-injury manner to compare scores (Iverson, Lovell, & Collins, 2005; Resch et al., 2013). There was some unreliability that was found, but mostly seen

when there was no pre-injury comparison score, or if the time frame was too early to appreciate a more symptom-free assessment (Resch et al., 2013). It turns out that most clinicians use the testing following a concussion at least two weeks after the injury (Resch et al., 2013; Rose et al., 2015). In an observational study, one team demonstrated that a type of neuropsychological testing, ImPACT, had high sensitivities (94.1%) and specificity (69.1%) for diagnosis of concussion; even when athletes said they were asymptomatic and suspected of hiding concussions the data was the same for sensitivities and specificity (Schatz & Sandel, 2013). The authors provided the same recommendation that pre- and post-injury would improve scores (Schatz & Sandel, 2013). Altogether, research supports use of neuropsychological testing, yet it should always been seen and used as an adjunct to current therapy with an aim to support progress or quantify progress (Rose et al., 2015).

The remainder of the evidence profile supports recommendation of this action statement. The risks are mainly the cost occurred when taking a neuropsychological test, and the possibility of intentional poor performance, even though this can be somewhat screened during the evaluation of many psychological testing (Resch et al., 2013). The value statement is based on a score to show improvement or lack thereof, that will support ongoing therapy or the RTP of a child or teen. Quantifiable scores are a means to support the current effort and measure the progress of the patient (Resch et al., 2013). There are many types of neuropsychological testing and none are named in the CPG so that they can be followed by the PCP or specialty care provider. There is no patient preference for this statement. And currently most neuropsychological testing is available for children over the age of eight years (Resch et al., 2013).

Guideline Implementation and Utilization

This CPG was initially designed to be implemented locally for pediatric PCPs in the metropolitan area of Minneapolis, MN. The expanded intent is that with a non-specific design following the AAP model, this CPG can be available for implementation and utilization at the state level and beyond if needed.

Funding/Conflict of Interest

This CPG was created as the project and work of a Doctor of Nursing Practice student. There has been no funding for creation of this project; there has been no receipt of any grant money for the development of this CPG. There are no conflicts of interest that would sway the independent development of this project or compromise the editorial independence.

Conclusion

Chapter IV of this project addressed the objective and description of the CPG, along with the target population. The CPG with key action statements for concussion management were presented. The areas of management included: diagnosis, prevention, treatment, and patient and parent education for pediatric concussions. Listed for each key action statement, was an evidence profile and discussion section. Lastly, after discussion of all the key action statements there were brief sections on implementation and utilization of the CPG, and funding/conflict of interest.

CHAPTER V: EVALUATION

Introduction

This chapter addresses the evaluation of the CPG using the AGREE II appraisal and evaluation tool. Two appraisers have viewed and systematically evaluated the Pediatric Concussion Clinical Practice Guideline via the "My AGREE Plus" website and platform. AGREE II, as discussed in Chapter III, is reliable tool for evaluating clinical practice guidelines. The AGREE II tool will be revisited in this chapter, along with the individual and overall results from the appraisers. This chapter will also cover limitations of the evaluation and recommendations for revision of the CPG. Lastly, this chapter will include a discussion on implications for dissemination into practice.

AGREE II

The AGREE II tool was first published in 2003 as a means to aid in the development and assessment of quality guidelines (Brouwers et al., 2010; Steering Committee on Quality Improvement and Management, 2004). As described in chapter III, the quality of a guideline can vary. The IOM listed guidelines that are desirable have the following traits: validity, reliability and reproducibility, clinical applicability, clinical flexibility, clarity, documentation, multidisciplinary development and plans for review (Institute of Medicine, 1992). The AGREE Collaboration, that originally published the instrument in 2003, described a quality guideline with three components: bias has been addressed, the guidelines are externally and internally valid, and are ultimately realistic for implementation into practice (Brouwers et al., 2010). In order to meet this criteria, the AGREE Collaboration designed the appraisal instrument with 23 questions that address six domains: scope and purpose, stakeholder involvement, rigor of

development, clarity of presentation, applicability, and editorial independence (Brouwers et al., 2010). With more use of the AGREE instrument, there was a need to update the tool to improve upon the usability, validity and reliability (Brouwers et al., 2010). This process was done via two studies through the AGREE Next Steps Research Consortium and the resultant AGREE II instrument was formed (Brouwers et al., 2010). There are still the same number of questions and domains with improved user manual for ease of understanding and interpreting guidelines and increased usefulness of tools for uploading data (Brouwers et al., 2010). The AGREE II score sheet used to appraise guidelines can be found in Appendix E.

The AGREE Collaboration has an appraiser website, called "My AGREE Plus" and users are invited to participate in the appraising of guidelines by the author. AGREE II authors recommend that at least two people appraise a guideline, and ideally up to four people (Brouwers et al., 2010). It is also recommended to invite content area experts in order to help with the ease of appraisal and understanding the guideline (Brouwers et al., 2010). One rationale for this is to ensure that the guidelines are expert reviewed and because each appraisal can take up to one and a half hours for completion (Brouwers et al., 2010). This project had two appraisers out of four that were asked to participate. Both appraisers are Masters-prepared advance practice registered nurses (APRN) with specialty certification as Pediatric Nurse Practitioners (PNP). The years of experience between the two APRN's is 10 years of advanced practice nursing with pediatric patients in primary care settings. Each appraiser was invited to appraise the guideline using the "My AGREE Plus" website.

AGREE II Results

The AGREE II results individual scores for each question, along with any user comments, and a cumulative score for each domain (Brouwers et al., 2010). For this project, the scores were uploaded to a specialty score sheet, called the Seven-Point AGREE II Score Calculator, that was acquired through the Capacity Enhancement Program (CEP) (2012). This program was designed to give more tools to aid in the further usefulness of understanding and application of the AGREE II instrument (CEP, 2012). This partner organization is mainly designed to help with cancer data and guideline use, but has applicability for any data that can be extracted from the AGREE II scoring sheet. The results of the Seven-Point AGREE II Score Calculator can be found in Appendix F.

The overall combined score of the six domains from the two appraisers were 94%, 83%, 81%, 92%, 81% and 96% respectively. The standard deviations (SD) for all the domains were below 1, which is indicative of low discrepancy. The overall assessment of the CPG provided a SD of 0.0, which showed that both appraisers had the same score of six out of seven. Both appraisers answered "yes" the final question of whether or not they would recommend this guideline for clinical use.

Using the AGREE II, "My AGREE Plus" website for appraisal of guidelines, has the added advantage of stating comments for any of the 23 questions. There were a few positive comments that expressed ease of understanding, and other comments that expressed areas of enhancement. The recommendations for enhancements in certain areas are listed: in domain 2 (Stakeholder Involvement), item 4 there was concern about only one person in the development group for such a task as this; in domain 3 (Rigor of Development), item 9 there was concern

about a lack of clarity with the methodology in the guideline; in domain 3, item14 there was concern about a lack of clarity on the process of evaluation following implementation; in domain 5 (Applicability), item 18, the was a question about who would be the facilitators for implementation.

Given the scores and the user comments, domain three, Rigor of Development, proved to be the weakest domain. It did tie for overall score of 81% with domain five, Applicability, although there were more questions and areas for improvement with domain three. With review of the overall scores and recommendations the CPG proved to have a very favorable SD of each domain of less than 0.5 and an overall guideline assessment SD of 0. Using the Seven-Point AGREE II Score Calculator, there are recommendations that are based on SD of each domain and the overall assessment. The calculator will determine if the guideline would benefit from some revision on certain domains or if no revisions are needed based on the scores, using the Decision Rule. For this project, and based on two appraisers, the calculator Decision Rule states that "no action required" for this CPG. The Decision Rule is also included in Appendix F. Although this is stated, any recommendations for improvement are to be addressed to maximize benefit and ease of use and ultimately adoption of a guideline by clinical target users.

Limitations

Brouwers et al. (2010) discuss limitations of the AGREE II instrument, in that it cannot guarantee acceptable or improved health outcome for patients based solely on rigor of development of guidelines, along with the methods of development. But given those standards, the likelihood of producing quality guidelines is increased and that is one of the challenges with a general tool or instrument, such as the AGREE II.

This CPG was created by one person for a DNP project. It was one of the recommendations to have a team of experts to prepare and produce guidelines (Brouwers et al., 2010). But in the setting of DNP scholarly work, the AGREE II tool is used for purposes of ensuring a solid and valid framework. With this information, there is much information explained in the project, that cannot be placed into the succinct CPG. This information would certainly help with domain three, Rigor of Development, to help understanding methods and evidence research.

Practice Discussion

This project addresses a clinical practice gap where evidence does not fully support some aspects of care for pediatric concussion therapy. This project was designed to aid in the discussion and education of concussions for patients and families, along with diagnosis, prevention and treatment for patients that have sustained a concussion. Currently there is no CPG that addresses all these aspects (Wells et al., 2015). Specifically, there is a wide range of accepted interpretations of "rest" in the literature, that can prove to be confusing for many in the primary care setting. The goal of this CPG was to address when to diagnose a concussion, the most current evidence-based recommendations for rest and exercise and then prevention and education. This CPG is designed to reduce ambiguity in the primary concussion visit and to have clear starting point for the process for recovery.

In order to continue with improvement on the CPG, the data need to be monitored and analyzed to assure quality. This would best be done with evaluations of the CPG on an annual basis. In addition, after adoption, it would be prudent to conduct focus group assessments of key

stakeholders during the implementation process to be sure that adoption is happening and identifying barriers to use (Brouwers et al., 2010).

Conclusion

Concussion diagnosis and awareness is increasing and more primary care providers are tasked with managing care of pediatric concussions. A current and evidence-based CPG was developed to assist and provide guidance to pediatric PCP's. The featured CPG in this project, is supported by evidence, and will help combat the concern that concussions need improved management from the primary care setting (Rose et al., 2015). Doctoral prepared APRN's are in a position to apply this evidence-based clinical practice guideline to their practice of managing pediatric concussion patients.

APPENDIX A

POST-CONCUSSION SYMPTOMS AND SCHOOL ACCOMMODATIONS

Postconcussion Symptoms and School Accommodations

Postconcussion Symptoms	Functional School Problem	Accommodation or Management Strategy
Attention or Concentration	Short focus on lecture, classwork, homework	Shorter assignments, break down tasks, lighter work load
Working Memory	Holding instructions in mind, reading comprehension, math calculation, writing	Repetition, written instructions, use of calculator, short reading passages
Memory Consolidation or Retrieval	Retaining new information, accessing learned info when needed	Smaller amounts to learn, recognition cues
Processing Speed	Keep pace with work demand, process verbal information effectively	Extended time, slow down verbal info, comprehension-checking
Cognitive Fatigue	Decreased arousal or activation to engage basic attention, working memory	Rest breaks during classes, homework, and examinations
Anxiety	Interferes with concentration; student may push through symptoms to prevent falling behind	Reassurance from teachers and team about accommodations; workload reduction, alternate forms of testing
Depression or Withdrawal	Withdrawal from school or friends due to stigma or activity restrictions	Engage student with friends at lunch or recess, build in time for socialization
Irritability	Poor tolerance for stress, alienate peers or teachers	Reduce stimulation and stressors, provide rest break
Headaches	Interferes with concentration, increased irritability	Rest breaks, short nap
Light or Noise Sensitivity	Symptoms worsen in bright or loud environments	Temporarily wear sunglasses, seating away from bright sunlight or other light; avoid noisy or crowded environments such as lunchroom, assemblies, and hallways
Dizziness or Balance Problems	Unsteadiness when walking	Elevator pass, class transition before bell
Sleep Disturbance	Decreased arousal, shifted sleep schedule	Later start time, shortened day
Symptom Sensitivity (exertional effects)	Symptoms worsen with over-activity, resulting in any of the previously listed problems	Reduce cognitive or physical demands below symptom threshold; provide rest breaks; complete work in small increments until symptom threshold increases

(Gioia, 2016; Iverson & Gioia, 2016)

APPENDIX B

GRADED RETURN TO SCHOOL APPROACH

Graded Return to School Approach

Stage	Description	Activity Level	Criteria to Move to Next Stage
0	No return, at home	Maintain low level cognitive and physical activity; no prolonged concentration Cognitive readiness challenge: as symptoms improve, try reading or math challenge task for 10–30 minutes; assess for symptom increase	• 1. Student can sustain concentration for 30 minutes before significant symptom exacerbation • 2. Symptoms reduce or disappear with cognitive rest breaks, [a] allowing the student to return to the activity
1	Return to school, partial day (1–3 hours)	Attend 1–3 classes, with interspersed rest breaks; minimal expectations for productivity; no tests or homework	Student's symptoms are improving, able to tolerate 4–5 hours of activity with 2–3 cognitive rest breaks built into school day
2	Full day, maximal supports (maximal supports needed throughout day)	Attend most classes, with 2–3 rest breaks (20–30 minutes), no tests; minimal homework (≤60 minutes); minimal-moderate expectations for productivity	Number and severity of symptoms improving, and needs only 1–2 cognitive rest breaks built into school day
3	Full day, moderate supports (moderate supports provided in response to symptoms during the day)	Attend all classes with 1–2 rest breaks (20–30 minutes); begin quizzes; moderate homework (60–90 minutes); moderate expectations for productivity; design schedule for make-up work	Continued symptom improvement, and needs no more than 1 cognitive rest break per day
4	Full day, minimal supports (monitoring final recovery)	Attend all classes with 0–1 rest breaks (20–30 minutes); begin modified tests (with breaks and/or extra time, if needed); normal homework schedule (90 + minutes); moderate-maximum expectations for productivity	No active symptoms throughout the school day
5	Full return, no supports needed	Full class schedule, no rest breaks; maximum expectations for productivity; begin to address make-up work	—

(Gioia, 2016; Iverson & Gioia, 2016)

APPENDIX C

ACE CARE PLAN

HEADS UP CONCUSSION

Acute Concussion EvAluAtion (Ace) CAre PlAn

Gerard Gioia, PhD[1] & Micky Collins, PhD[2]
[1]Children's National Medical Center
[2]University of Pittsburgh Medical Center

Patient Name:_____
DOB:_____Age: _____
Date:_____ID/MR# _____
Date of Injury:_____

You have been diagnosed with a concussion (also known as a mild traumatic brain injury). This personal plan is based on your symptoms and is designed to help speed your recovery. Your careful attention to it can also prevent further injury.

You should not participate in any high risk activities (e.g., sports, physical education (PE), riding a bike, etc.) if you still have any of the symptoms below. It is important to limit activities that require a lot of thinking or concentration (homework, job-related activities), as this can also make your symptoms worse. If you no longer have any symptoms and believe that your concentration and thinking are back to normal, you can slowly and carefully return to your daily activities. Children and teenagers will need help from their parents, teachers, coaches, or athletic trainers to help monitor their recovery and return to activities.

Today the following symptoms are present (circle or check). **__No reported symptoms**

Physical		Thinking	Emotional	Sleep
Headaches	Sensitivity to light	Feeling mentally foggy	Irritability	Drowsiness
Nausea	Sensitivity to noise	Problems concentrating	Sadness	Sleeping more than usual
Fatigue	Numbness/Tingling	Problems remembering	Feeling more emotional	Sleeping less than usual
Visual problems	Vomiting	Feeling more slowed down	Nervousness	Trouble falling asleep
Balance Problems	Dizziness			

RED FLAGS: Call your doctor or go to your emergency department if you suddenly experience any of the following

Headaches that worsen	Look very drowsy, can't be awakened	Can't recognize people or places	Unusual behavior change
Seizures	Repeated vomiting	Increasing confusion	Increasing irritability
Neck pain	Slurred speech	Weakness or numbness in arms or legs	Loss of consciousness

— SCHOOL VERSION —

Returning to Daily Activities

1. Get lots of rest. Be sure to get enough sleep at night- no late nights. Keep the same bedtime weekdays and weekends.
2. Take daytime naps or rest breaks when you feel tired or fatigued.
3. **Limit physical activity as well as activities that require a lot of thinking or concentration. These activities can make symptoms worse.**
   - Physical activity includes PE, sports practices, weight-training, running, exercising, heavy lifting, etc.
   - Thinking and concentration activities (e.g., homework, classwork load, job-related activity).
4. Drink lots of fluids and eat carbohydrates or protein to main appropriate blood sugar levels.
5. **As symptoms decrease, you may begin to gradually return to your daily activities. If symptoms worsen or return, lessen your activities, then try again to increase your activities gradually.**
6. During recovery, it is normal to feel frustrated and sad when you do not feel right and you can't be as active as usual.
7. Repeated evaluation of your symptoms is recommended to help guide recovery.

Returning to School

1. If you (or your child) are still having symptoms of concussion you may need extra help to perform school-related activities. As your (or your child's) symptoms decrease during recovery, the extra help or supports can be removed gradually.
2. Inform the teacher(s), school nurse, school psychologist or counselor, and administrator(s) about your (or your child's) injury and symptoms. School personnel should be instructed to watch for:
   - Increased problems paying attention or concentrating
   - Increased problems remembering or learning new information
   - Longer time needed to complete tasks or assignments
   - Greater irritability, less able to cope with stress
   - Symptoms worsen (e.g., headache, tiredness) when doing schoolwork

~Continued on back page~

This form is part of the"Heads Up: Brain Injury in Your Practice"tool kit developed by the Centers for Disease Control and Prevention (CDC).

Returning to School (Continued)

Until you (or your child) have fully recovered, the following supports are recommended: *(check all that apply)*

__No return to school. Return on (date)_____

__Return to school with following supports. Review on (date)_____

__Shortened day. Recommend____hours per day until (date)_____

__Shortened classes (i.e., rest breaks during classes). Maximum class length:_____minutes.

__Allow extra time to complete coursework/assignments and tests.

__Lessen homework load by_____%. Maximum length of nightly homework:_____minutes.

__No significant classroom or standardized testing at this time.

__Check for the return of symptoms (use symptom table on front page of this form) when doing activities that require a lot of attention or concentration.

__Take rest breaks during the day as needed.

__Request meeting of 504 or School Management Team to discuss this plan and needed supports.

Returning to Sports

1. **You should NEVER return to play if you still have ANY symptoms** – (Be sure that you do not have any symptoms at rest and while doing any physical activity and/or activities that require a lot of thinking or concentration.)
2. Be sure that the PE teacher, coach, and/or athletic trainer are aware of your injury and symptoms.
3. It is normal to feel frustrated, sad and even angry because you cannot return to sports right away. With any injury, a full recovery will reduce the chances of getting hurt again. It is better to miss one or two games than the whole season.

The following are recommended at the present time:

___ Do not return to PE class at this time

___ Return to PE class

___ Do not return to sports practices/games at this time

___ **Gradual** return to sports practices under the supervision of an appropriate health care provider.

- ï Return to play should occur in gradual steps beginning with aerobic exercise only to increase your heart rate (e.g., stationary cycle); moving to increasing your heart rate with movement (e.g., running); then adding controlled contact if appropriate; and finally return to sports competition.
- ï Pay careful attention to your symptoms and your thinking and concentration skills at each stage of activity. Move to the next level of activity only if you do not experience any symptoms at the each level. If your symptoms return, stop these activities and let your health care professional know. Once you have not experienced symptoms for a minimum of 24 hours and you receive permission from your health care professional, you should start again at the previous step of the return to play plan.

Gradual Return to Play Plan

1. No physical activity
2. Low levels of physical activity (i.e.,). This includes walking, light jogging, light stationary biking, light weightlifting (lower weight, higher reps, no bench, no squat).
3. Moderate levels of physical activity with body/head movement. This includes moderate jogging, brief running, moderate-intensity stationary biking, moderate-intensity weightlifting (reduced time and/or reduced weight from your typical routine).
4. Heavy non-contact physical activity. This includes sprinting/running, high-intensity stationary biking, regular weightlifting routine, non-contact sport-specific drills (in 3 planes of movement).
5. Full contact in controlled practice.
6. Full contact in game play.

*Neuropsychological testing can provide valuable information to assist physicians with treatment planning, such as return to play decisions.

This referral plan is based on today's evaluation:

___ Return to this office. Date/Time_____

___ Refer to: Neurosurgery____Neurology____Sports Medicine____Physiatrist____Psychiatrist____Other____

___ Refer for neuropsychological testing

___ Other_____

ACE Care Plan Completed by:_____**MD RN NP PhD ATC**

APPENDIX D

CLINICAL PRACTICE GUIDELINE

Concussion Clinical Practice Guidelines for Pediatric PCPs

Objective

The primary objective of the following CPG is to provide pediatric PCPs with an evidence-based guide for the management of pediatric concussions. It will also introduce evidence-based rationale for specialty referral for concussions in children. A secondary objective is to reduce the likelihood of long-term complications and improve quality of life for children and families following a concussion.

Population

The CPG that follows is intended for use in the management of pediatric patients, ages 0-18 years old, male and female, who are treated by pediatric PCPs in a primary care setting. PCPs in the pediatric setting include physicians, nurse practitioners, and physician assistants who care for pediatric patients as defined above.

Key Action Statement 1

Clinicians should diagnose a concussion in any child with direct or indirect head injury who presents to the primary care setting with any symptom on the CDC ACE Care Plan.

Key Action Statement Profile: KAS 1

Aggregate evidence quality	Grade B
Benefits	Promotes incidence of correct diagnosis of concussion. Reduction in missed diagnosis and worsening symptoms. Increases likelihood of returning to school and/or sports sooner than a missed diagnosis.
Risks, harm, cost	No risk or harm; possible cost for training providers
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value for importance of accurate diagnosis
Intentional vagueness	"Direct or indirect" is used so that clinician may use discernment when assessing and making concussion diagnosis
Role of patient preferences	None
Exclusions	Infants
Strength	**Strong Recommendation**

Key Action Statement 2.

Clinicians should recommend proper safety equipment for playing sports and educate patients and families on its importance.

Key Action Statement Profile: KAS 2

Aggregate evidence quality	Grade C
Benefits	Promotes ownership in safety training for the child. Prevents injuries and decreases chances for concussions.
Risks, harm, cost	No risk or harm; possible cost of time when providing education for the child/teen athlete
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value in prevention of injury and promotion of safety
Intentional vagueness	No specific types of safety equipment mentioned, so clinicians can tailor information to specific activities
Role of patient preferences	Limited to what the patient is willing to wear and what is required by the sporting laws
Exclusions	None
Strength	Recommendation

Key Action Statement 3a.

Clinicians should recommend no more than 1-3 days of physical and cognitive rest following a concussion diagnosis.

Key Action Statement Profile: KAS 3a

Aggregate evidence quality	Grade C
Benefits	Standard recommended time to rest and then return to social activities. Promotes a realistic time of physical and mental rest. Does not set the youth up for failure by requiring unrealistic expectations and promotes reintegration to social activities.
Risks, harm, cost	Risk of continuing symptoms that may not resolve in 1-2 days, but longer rest periods are not associated with quicker symptom resolution; Harm, none; Cost, missed school/work for parents

Benefits-harms assessment	Preponderance of benefit over risk
Value judgements	High value in research supporting shorter rest periods and returning to social activities to promote better recovery
Intentional vagueness	None
Role of patient preferences	None
Exclusions	None
Strength	Recommendation

Key Action Statement 3b

Clinicians should fill out and use CDC ACE Care Plan for school accommodations when concussed children are returning to school.

Key Action Statement Profile: KAS 3b

Aggregate evidence quality	**Grade C**
Benefits	Reduction in missed school and social integration by providing accommodations. To promote better resolution of symptoms, accommodations will allow for the student to remain in class. Prevents protracted recovery when students feel isolated. Promotes further communication between educators and clinicians to discuss progress and symptoms.
Risks, harm, cost	No risk or harm; possible cost of paper and time for filling out form
Benefits-harms assessment	Preponderance of benefit
Value judgements	High value placed on the importance a standard accommodation form and returning to school as soon as possible
Intentional vagueness	None
Role of patient preferences	Form can be modified and selected to best suit the patient's needs
Exclusions	Non-school-Aged patients
Strength	Recommendation

Key Action Statement 3c.

Clinicians should refer to specialty care when patients present to the primary care setting with symptoms of HA, Dizziness and/or visual disturbances lasting longer than one week.

Key Action Statement Profile: KAS 3c

Aggregate evidence quality	Grade C
Benefits	Reduction in protracted recovery. Improved return to normal activities when referred for these symptoms.
Risks, harm, cost	Risk of referral when symptoms are within normal limits; no harm; Cost of referral and specialty care, deductible cost and insurance coverage variability
Benefits-harms assessment	Preponderance of benefit over risk
Value judgements	Early specialty care for sustained symptoms to promote better symptom resolution
Intentional vagueness	No specific type of care noted
Role of patient preferences	Limited to what patient and family are willing to participate in and what benefits they perceive
Exclusions	None
Strength	Recommendation

Recommendation 4a

Clinicians should discuss with patients and parents the importance of the RTP steps and of the need for written clearance prior to full participation in sports.

Key Action Statement Profile: KAS 4a

Aggregate evidence quality	Grade B
Benefits	Standardized and formulaic steps to appropriately stress the body in levels and prevent returning to full contact sports or vigorous training too early. Prevents re-injury and promotes a safe return to full activity.
Risks, harm, cost	Risk and harm of non-compliance and return to play too soon, although written clearance is designed to assure proper RTP; cost of time and appointments for frequent training and check-ups to assess progress
Benefits-harms assessment	Preponderance of benefit over harm
Value judgements	High value placed on the importance of a set of therapeutic management criteria.
Intentional vagueness	None

Role of patient preferences	Patient able to be cleared/followed by specialty care, PCP or sports trainer
Exclusions	Children not in competitive sports or younger
Strength	**Strong Recommendation**

Recommendation 4b.

Clinicians will recommend pre- and post-injury neuropsychological testing for children/athletes that participate in sports.

Key Action Statement Profile: KAS 4b

Aggregate evidence quality	**Grade C**
Benefits	Baseline information on neuropsychological testing can be compared with post-injury testing to aid in determining recovery status.
Risks, harm, cost	Risk of intentional poor performance on pre-test; no harm; cost of testing.
Benefits-harms assessment	Preponderance of benefit over risk
Value judgements	Value in a quantifiable score to aide in assessing recovery
Intentional vagueness	No specific testing named, there may be more than one type
Role of patient preferences	None
Exclusions	Children under 8, neuropsychological testing not made for this age range
Strength	Recommendation

Guideline Implementation

This CPG was initially designed to be implemented locally for pediatric PCPs in the metropolitan area of Minneapolis, MN. The expanded intent is that with a non-specific design following the AAP model, this CPG can be available for implementation and utilization at the state level and beyond if needed.

Funding/Conflict of Interest

This CPG was created as the project and work of a Doctor of Nursing Practice student. There has been no funding for creation of this project; there has been no receipt of any grant money for the development of this CPG. There are no conflicts of interest that would sway the independent development of this project or compromise the editorial independence.

APPENDIX E

AGREE II SCORE SHEET

AGREE II Score Sheet

Domain	Item	AGREE II Rating						
		1 *Strongly Disagree*	2	3	4	5	6	7 *Strongly Agree*
Scope and purpose	1. The overall objective(s) of the guideline is (are) specifically described.							
	2. The health question(s) covered by the guideline is (are) specifically described.							
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.							
Stakeholder involvement	4. The guideline development group includes individuals from all the relevant professional groups.							
	5. The views and preferences of the target population (patients, public, etc.) have been sought.							
	6. The target users of the guideline are clearly defined.							
Rigor of development	7. Systematic methods were used to search for evidence.							
	8. The criteria for selecting the evidence are clearly described.							
	9. The strengths and limitations of the body of evidence are clearly described.							
	10. The methods for formulating the recommendations are clearly described.							
	11. The health benefits, side effects and risks have been considered in formulating the recommendations.							
	12. There is an explicit link between the recommendations and the supporting evidence.							
	13. The guideline has been externally reviewed by experts prior to its publication.							
	14. A procedure for updating the guideline is provided.							
Clarity of presentation	15. The recommendations are specific and unambiguous.							
	16. The different options for management of the condition or health issue are clearly presented.							
	17. Key recommendations are easily identifiable.							
Applicability	18. The guideline describes facilitators and barriers to its application.							
	19. The guideline provides advice and/or tools on how the recommendations can be put into practice.							
	20. The potential resource implications of applying the recommendations have been considered.							
	21. The guideline presents monitoring and/ or auditing criteria.							
Editorial independence	22. The views of the funding body have not influenced the content of the guideline.							
	23. Competing interests of guideline development group members have been recorded and addressed.							
Overall Guideline Assessment	1. Rate the overall quality of this guideline.	1 *Lowest possible quality*	2	3	4	5	6	7 *Highest possible quality*
Overall Guideline Assessment	**2. I would recommend this guideline for use.**	*Yes*		*Yes, with modifications*				*No*

APPENDIX F

AGREE II SEVEN POINT SCORE CALCULATOR RESULTS

Seven-point AGREE II Score Calculator

You must fill in **ALL** of the Question ratings from an appraiser for the Domain score to be accurate.
**Note: Please use the AGREE II User's Manual for full instructions.*

Total # of Appraisers	Appraiser				
2	1	2	3	4	
Domain 1 - Scope and Purpose					
Q1 - The overall objective(s) of the guideline is (are) specifically described.	6	7			13
Q2 - The health question(s) covered by the guideline is (are) specifically described.	6	7			13
Q3 - The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.	7	7			14
	19	21	Caution: Empty Cells	Caution: Empty Cells	40
				Domain 1 Score for 2 Appraiser(s):	94%
Domain 2 - Stakeholder Involvement					
Q4 - The guideline development group includes individuals from all relevant professional groups.	6	5			11
Q5 - The views and preferences of the target population (patients, public, etc.) have been sought.	6	5			11
Q6 - The target users of the guideline are clearly defined.	7	7			14
	19	17	Caution: Empty Cells	Caution: Empty Cells	36
				Domain 2 Score for 2 Appraiser(s):	83%
Domain 3 - Rigour of Development					
Q7 - Systematic methods were used to search for evidence.	6	5			11
Q8 - The criteria for selecting the evidence are clearly described.	6	6			12
Q9 - The strengths and limitations of the body of evidence are clearly described.	6	5			11
Q10 - The methods for formulating the recommendations are clearly described.	6	6			12
Q11 - The health benefits, side effects, and risks have been considered in formulating the recommendations.	7	6			13
Q12 - There is an explicit link between the recommendations and the supporting evidence.	6	6			12
Q13 - The guideline has been externally reviewed by experts prior to its publication.	6	6			12
Q14 - A procedure for updating the guideline is provided.	6	5			11
	49	45	Caution: Empty	Caution: Empty	94
				Domain 3 Score for 2 Appraiser(s):	81%
Domain 4 - Clarity of Presentation					
Q15 - The recommendations are specific and unambiguous.	6	7			13
Q16 - The different options for management of the condition or health issue are clearly presented.	6	6			12
Q17 - Key recommendations are easily identifiable	7	7			14
	19	20	Caution: Empty Cells	Caution: Empty Cells	39
				Domain 4 Score for 2 Appraiser(s):	92%
Domain 5 - Applicability					
Q18 - The guideline describes facilitators and barriers to its application.	6	5			11
Q19 - The guideline provides advice and/or tools on how the recommendations can be put into practice.	6	6			12
Q20 - The potential resource implications of applying the recommendations have been considered.	6	6			12
Q21 - The guideline presents monitoring and/or auditing criteria.	6	6			12
	24	23	Caution: Empty Cells	Caution: Empty Cells	47
				Domain 5 Score for 2 Appraiser(s):	81%
Domain 6 - Editorial Independence					
Q22 - The views of the funding body have not influenced the content of the guideline.	7	7			14
Q23 - Competing interests of guideline development group members have been recorded and addressed.	6	7			13
	13	14	Caution: Empty	Caution: Empty	27
				Domain 6 Score for 2 Appraiser(s):	96%
Overall Guideline Assessment					
1. Rate the overall quality of this guideline. *Scoring: 1(Least Quality) - 7(Highest Quality)*	6	6			
2. I would recommend this guideline for use. *Scoring: "Yes", "Yes, with modifications", "No"*	yes	yes			

DATA AUDIT

# of Domains with SD that are >=1.5 and <2 SD (OS: Outlying Score, first level severity)	0
# of Domains with SD that are >=2 SD (OS2: Outlying Score, 2nd level severity)	0

Decision Rule:

Of Domains 1-5 and the Overall Assessment
OS >=3 or OS2 >=1

No action required

Average Standard Deviation of Items by Domain

Domain	Standard Deviation	Discrepancy Level
1	0.47	LOW
2	0.47	LOW
3	0.35	LOW
4	0.24	LOW
5	0.18	LOW
Overall Guideline Assessment	0.00	LOW

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