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Pediatric Primary Care Concussion Evaluation and Management

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PEDIATRIC PRIMARY CARE CONCUSSION EVALUATION AND MANAGEMENT

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

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ABSTRACT

Concussions are an important and timely subject, especially within the pediatric population, as they are the most involved in extracurricular contact sports and are susceptible to concussions and their sequelae. The researcher performed a quasi-experimental pilot study in a pediatric primary care office where the researcher educated 15 providers on the HEADS UP concussion screening tool and management approach. The researcher gave providers pre- and post-intervention surveys to determine if providers' comfort and knowledge regarding assessing and managing concussions within the pediatric primary care setting changed. Four providers participated in the study. The researcher conducted a chart review two months after the educational intervention to assess changes in clinical care. Retrospective chart review of pre-education concussion care demonstrated varied evaluation and management approaches. Post-education chart review found one of the four providers using the full educational intervention. Therefore, targeted education and a chart review may be helpful to improve providers' behaviors and actions related to clinical practice guidelines.

Keywords: Concussion, HEADS UP, pediatric, primary care, chart audit.

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List of Abbreviations

Center for Disease Control and Prevention (CDC)

Collective IRB Training Initiative (CITI)

Electronic Medical Record (EMR)

Evidence Based Practice (EBP)

Institutional Review Board (IRB)

King Devick (KD)

Medical Doctor (MD)

Nursing Research Council (NRC)

Nurse Practitioner (NP)

Sport Concussion Assessment Tool (SCAT)

The topic of concussions, and more specifically concussion evaluation and management is timely among various populations. Health care professionals, parents and pediatric patients are more interested in concussions than ever before. More and more youths are involved in recreational sports and the competitive nature of sports is consistently rising, causing the incidence of concussions among athletes to be at an all-time high (Riesner, 2017). According to Caldwell (2014) the overall rate of concussions has increased from 0.23 to 0.51 per 1,000 exposures. In the state where this project was completed, high schools are required to report the number of concussions per year to raise awareness on the topic of concussions. The local high schools have developed a concussion protocol that is designed to recognize concussions early and refer students promptly to medical care. Educating primary care providers on the adequate assessment and management of concussions is important to reduce the negative effects associated with concussions and to reduce the risk of further injury..

Adequately assessing and managing concussions is important, especially in the fragile neurological system of a developing child or adolescent (Gillooly, 2016). Although healthcare is never supposed to be a "one size fits all" entity, some consistency should exist among providers to arrange for the best possible patient outcomes and the most cost-effective care. Concussion screening and management is an area with wide variation between providers, which can lead to the underdiagnoses of concussions and subsequent mismanagement of patients with concussions. Mismanagement could include inconsistent return to play guidelines, inadequate cognitive rest and ultimately a longer recovery process with the potential for relapsing symptoms which can lead to serious quality of life issues for patients and their families (Riesner et al., 2017).

Approaches vary related to concussion screening and management and can lead to poorer outcomes for patients. The average lifetime cost of a single concussion can be anywhere from

$85,000 to 3 million and with the frequency of concussions, especially among the pediatric population, this can be an extreme hardship for a family to overcome (Edmonds, 2015). Besides the cost of a concussion, the potential sequelae of a concussion can lead to many quality-of-life issues, including chronic headaches, neck pain, and other residual effects of concussions. This is especially apparent in patients who have had multiple concussions, as having once concussion increases susceptibility for future concussions (Riesner et al., 2017).

Unifying primary care providers and providing them with a validated concussion screening tool and management protocol could improve the accurate and timely diagnosis of concussions among pediatric patients, thus positively impacting patient outcomes, improving the burden of illness, improving recovery time, and reducing costs for patients and their families.

Background

Concussions within the pediatric population are common and have the potential to significantly impact a child's life in the short- and long-term (Karlin, 2011). Previous definitions of a concussion required a loss of consciousness with an associated head injury for a concussion to be diagnosed; however, it has now been widely accepted that a loss of consciousness is not required to sustain a concussion. In fact, according to the American Academy of Pediatrics (2017), the large majority of concussions occur without loss of consciousness (Karlin, 2011). According to Karlin (2011), a concussion can be defined as a "complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces" (pg. 369).

According to Karlin (2011), 30-45 million children and adolescents participate in nonscholastic organized sports across the United States each year. An estimated 7.6 million adolescents participated in high school sports, and 1.1 million of that figure is represented by high school football players (Karlin, 2011). The Center for Disease Control and Prevention

(CDC) estimates that an average of 1.7 million concussions occur each year; 20% are sport related (Karlin, 2011). These numbers are said to be skewed and underreported, as many concussions are initially missed on the field, due to a lack of follow up with medical professionals, or because of the failure to report symptoms for fear of lost playing time (Karlin, 2011). One study showed that 70% of students reported symptoms of a concussion, but of that 70%, only 20% had realized that they had sustained a concussion (Karlin, 2011).

Karlin (2011) reported that the sports with the highest incidence of concussions were football, ice hockey, soccer, wrestling, basketball, field hockey, baseball, softball and volleyball. Typically, children and adolescents sustain concussions related to sports, and 53% of student athletes reported a history of concussion by the start of high school (Karlin, 2011). The financial burden of concussions in the pediatric population is quite overwhelming. Graves and Klein (2016) report that a single pediatric concussion claim can cost up to $543 and can be exorbitantly higher if the concussion is not diagnosed early or is mismanaged.

Pediatric patients are at a much higher risk for developing a concussion due to several different physiologic factors. A prior belief was that the plasticity in the pediatric brain was a protective factor in concussions; however, many studies have shown that the rate of concussions among high school athletes is much higher than that of older athletes (Karlin, 2011). Another interesting statistic is that the average recovery time for a pediatric patient with a concussion is 10-14 days, as compared with 5-7 days in a collegiate athlete, thus indicating the need for a management plan that has age-specific guidelines (Karlin, 2011).

Other physiologic factors that may contribute to an increased incidence of concussions within the pediatric population include immaturity of the developing nervous system, an increased head-to-body ratio, thinner cranial bones, a larger subarachnoid space allowing for

more free brain movement, and an increased cerebral blood volume (Karlin, 2011). According to Gillooly (2016), weaker neck muscles in the developing adolescent also contribute to the inability of the neck to dissipate the energy from the head to the rest of the body and put female athletes at a higher risk for developing a concussion than males. Karlin (2011) reports that after a head injury, more prolonged and widespread cerebral swelling occurs in children when compared to adults, and sensitivity to glutamate and N-methyl-d-aspartate has also been reported.

Problem Statement

Concussions are largely underdiagnosed and underreported, although they are prevalent among the pediatric athletic population, due to inconsistencies of screening tool usage and management methodology between providers (AAP, 2017; Gilloly, 2016; Halstead & Walter, 2010). Primary care providers often state that they perceive a lack of education or resources are available to correctly diagnose and manage concussions (Gilloly, 2016).

Purpose/Aim of Project

The purpose of this project was to evaluate the comfort and ability of pediatric primary care providers in diagnosing concussions in the pediatric population and to provide pediatric primary care providers with a validated screening tool and management approach. Providers were given a Likert-scale survey to determine their comfort level in diagnosing and managing concussions prior to and after the education was provided. The same group of providers were utilized to conduct a chart review to determine whether or not the providers had a change in clinical practice.

If the project is well-accepted, and the screening tool and management approach are adopted into clinical practice among pediatric primary care providers, pediatric concussion

patients would have a more timely and accurate diagnosis and would also fall under more specific management guidelines, which will allow for better outcomes for patients and will also reduce the costs and burden of illness associated with concussions. This will also empower primary care providers and reduce the number of referrals made to specialists, which may delay care.

Clinical Question

Will primary care providers (P) feel more comfortable with diagnosing and treating concussions as a result of targeted education on validated screening tools and management strategies (I) when compared to just using their preference (C) in clinical practice and readily use the screening tool and management strategy in clinical practice (O)?

Literature Review and Synthesis

The researcher conducted a literature review using CINAHL Plus Full Text, which is part of EbscoHost, as well as ProQuest. The researcher used key words including concussion, pediatric, athlete, assessment and management. The researcher used other key words including screening and tool to glean further information. The researcher assessed various levels of evidence, from systematic reviews to expert opinion to help bolster the literature review and demonstrate the need for the project to be carried out. The researcher reviewed articles from 2001 to present, as concussion assessment and management has evolved throughout the years. Most of the articles focused on the relevance of concussions within the pediatric population, the different screening tools used to diagnose concussions and the different evidence-based management approaches used when treating pediatric athletes.

Role of the Primary Care Provider

Primary care providers have the unique ability to care for patients of varying ages with different diagnoses. Although many injured athletes may present to their primary care provider for initial evaluation and management after a concussion, many primary care providers feel they have insufficient time to systematically diagnose and manage concussion patients (Arbogast et al., 2017). In addition to insufficient time, primary care providers often report a lack of resources and knowledge on the accurate assessment and management of patients who present with concussions, leading to limited adoption of best practices, over-referral to specialists, underdiagnosis of concussions and the mismanagement of patients who have concussions (Arbogast et al., 2017; Hoffmeister et al., 2015; Lovell & Fazio, 2008; Scorza et al., 2012).

Assessment/Screening

Screening to determine whether or not an athlete has sustained a concussion should take place multiple times. First, the athlete should be assessed immediately after the injury has been sustained and once stabilized, he or she should again be assessed by either an athletic trainer or coach who is trained on concussion screening (Esquivel et al., 2013). Although athletic trainers and coaches are typically well versed in the areas of concussions and do a great job screening their athletes, follow-up needs to be established, as some symptoms of a concussion can be latent and not appear for up to 48 hours after the injury was sustained (McCrea, 2001).

According to Arbogast et al. (2017), patients with concussions typically seek medical care in one of two avenues: their primary care physician or the emergency room. No matter where the patient seeks evaluation, the literature points to the need for the concussion screening to be validated and streamlined (Coldren et al., 2012). Unfortunately, concussion screening varies widely from provider to provider, which can lead to inconsistencies in care delivery and

management approaches, poor patient outcomes and increased cost and burden of illness related to concussions.

Many validated concussion screening tools exist, including the King Devick (KD) scale, the Sport Concussion Assessment Tool (SCAT) and various others, including a virtual reality tool, the Balance App, which is used to determine neurologic deficits that may not be overt to the provider or the patient (Chin et al., 2016; Nolin et al., 2012; Seidman et al., 2015; Stone et al., 2015). Providers need to be aware of the different presentations that concussions may have, including short term memory loss, neurologic complaints, and sleep disturbances, which may exacerbate the patient's perceptions of their symptoms (Kostyun et al., 2014). In addition to having a screening tool that is validated, user-friendly and efficient, the provider also needs to understand that an age appropriate approach may be needed depending on the child's developmental level (Davis et al., 2017).

Management

After the primary care provider has appropriately identified a concussion, the next step would be to provide appropriate, evidence-based management guidelines. Typically, the pediatric patients who sustain concussions are involved in full-time scholastics, and cognitive rest was not a term that was discussed until recently. Many guidelines were published on the return to play protocols; however, cognitive rest is just as important. Management of pediatric patients who sustain concussions should always be directed by the current evidence (Stache, Howell & Meehan, 2016).

Unfortunately, management approaches differ between providers and institutions. In order to make a difference in both physical and academic outcomes post-concussion, the literature recommends streamlining the management protocol to a step-wise approach

(Aukerman, Phillips & Graham, 2016). Although the management approach is standardized, it can still be adjusted to fit individual patient needs and goals. Management is most often step-wise and involves the slow reintroduction of activity, both cognitive and physical (Guskiewicz et al., 2004). Typically, the athlete is prohibited from completing any physical activity until symptoms are absent, and cognitive activity is strictly restricted (Tator et al., 2013). The athlete must also be followed closely for any complications of the concussion, including post concussive syndrome and may need to be screened more frequently until symptoms dissipate (Resch & Kutcher, 2015).

Conceptual Framework

The Iowa Model was used as a conceptual framework when developing this project. The Iowa Model was developed by Marita Titler (Dontje, 2007). Although evidence-based practice is a term used quite frequently within the health care arena, the adoption of evidence-based practice can often be a challenge. EBP takes research that positively impacts patient populations and translates it into practice (Buckwalter et al., 2017). The Iowa Model helps the nurse researcher to outline a project or proposal and helps serve as a guideline for the necessary steps in order to evaluate trends, perform research and translate the research findings into practice. According to Doody (2011), seven steps are included in the use of the Iowa Model as a conceptual framework to complete an evidence-based practice project.

Identifying the trigger. The first part of using the Iowa Model includes selecting a topic that is relevant, has a significant magnitude, is applicable to multiple areas of nursing, and that is derived from either a clinical trigger or a knowledge-based trigger (Dontje, 2007; Doody, 2011). The topic should present from a gap in practice and should be a priority to the organization in which the evidence-based practice project is being completed (Dontje, 2007). This project stems

from a knowledge-based trigger, in that many primary care providers feel that they have inadequate resources and knowledge base to adequately care for this patient population with this particular diagnosis (Gilloly, 2016).

The purpose of this project was to assess primary care providers' attitudes and comfort levels in assessing and diagnosing concussions within the pediatric population prior to and after education was provided on a validated concussion screening tool and a step-wise management approach. Furthermore, after the education was completed, the researchers surveyed providers to assess learning post-presentation. In order to obtain objective data, the researcher conducted a chart review on two charts per provider, two months after the presentation to determine whether or not a change was made in clinical practice. The researcher reviewed one chart per provider retrospectively, prior to the education, and one chart per provider after the education.

Organizational priority. In order for an evidence-based practice project to be completed well, the project and topic must be a priority for the organization (Dontje, 2007). This will ensure that key stakeholders are invested in the development and completion of the project and that appropriate support and guidance are maintained throughout the project. Care and compassion are main drivers in the arena of health care, and prioritizing excellence and education opens the door for many innovative evidence-based practice projects to be carried out within the organization.

Identifying the team. For the purpose of completing this project, the team consisted of the team leader, and the chair of the scholarly project. A neutral budget was used, with the only financial resources going towards the educational material presented to the primary care providers and survey materials.

Examining the evidence. After the researcher formed the team, the researcher gathered evidence on the phenomenon of interest (Dontje, 2007; Doody, 2011). The evidence retrieval process is an important step in the project plan, as it helps to guide the team in knowing the research that already exists on the topic and the gaps in knowledge (Doody, 2011). The literature review for this project was previously outlined in detail, but much of the evidence pointed to the lack of resources and knowledge among the primary care area to adequately screen for and treat concussions.

Grading the evidence. After the evidence was collected, the researcher graded the evidence to determine the strength of the research done on the current topic (Doody, 2011). The researcher used Melnyk's pyramid for grading evidence ((University of Michigan Library, 2015). The researcher considered several expert opinion studies; however, also included systematic reviews in the literature review to bolster the evidence and the need for future interventions surrounding the topic of pediatric concussion management in primary care.

Determining a standard. After the evidence was retrieved and graded, the team developed an evidence-based standard to introduce into practice (Doody, 2011). For this project, the evidence-based practice standard included primary care providers adopting the validated screening tool and the step-wise management approach into their clinical practice.

Implementing the standard into practice. Finally, the researcher implemented the evidence-based practice standard into clinical practice and evaluated it to determine whether or not it improved patient outcomes (Doody, 2011). The projected implementation included educating the group of primary care providers on the validated concussion screening tool and management approach. The researcher assessed knowledge and comfort level of the primary care providers prior to the education and after the education to determine if the education was

successful. In addition to the education, the researcher conducted a chart audit two months after the education was provided to determine how they have integrated the screening tool and management approach into their everyday practice.

Analyze the outcomes. One of the last steps is analyzing the results, which included a post-educational chart review to determine if the providers were using the screening tool and management approach in clinical practice. Although the time-frame between the education intervention and the chart reviews was short, the researcher expected some providers to adopt the management strategies into their clinical practice. In addition to the chart reviews, the researcher distributed, collected, and analyzed pre- and post-education surveys. The final step in the Iowa Model is to disseminate the results of the project, which will occur by publishing a manuscript describing the project to various journals and creating a poster and podium presentation to use at appropriate conferences to improve the care of pediatric patients who present to their primary care provider with the chief complaint of a concussion.

Methodology

Design

This project was an evidence-based practice project that educated pediatric primary care providers, including physicians and nurse practitioners on a validated concussion screening tool and management protocol. This was considered a pilot study that assessed providers' knowledge and comfort level on assessing and managing concussions in the primary care setting. This project was underpinned by the Iowa Model of Evidence-Based Practice to promote the utilization of evidence-based practice in care.

The team leader provided a targeted education during an all-provider staff meeting, provided pre- and post-education surveys, which evaluated the comfort and knowledge among

providers regarding assessing and managing concussions among pediatric patients within the primary care realm. The researcher conducted a chart review for the four providers that participated two months after the initial educational intervention. The researcher included two charts per provider in the chart review, one retrospectively, prior to the education and one after the education. The researcher reviewed charts for use of the screening tool, and management recommendations that were presented during the educational session.

Measurable Outcomes

1. After completing the targeted education, primary care providers will demonstrate an increase in comfort and knowledge in accurately assessing, diagnosing and managing concussions in pediatric patients within the primary care setting as evidenced by an increase in scores on the concussion questionnaire.
2. After completing the targeted education, the primary care providers will begin to use the validated screening tool and management strategies in clinical practice, as evidenced by documentation in the EMR of the use of a validated screening tool within the clinical note for the visit. Two charts per provider will be reviewed two months after the education is complete.

Subjects

The targeted subjects for this project were pediatric primary care providers, including physicians and nurse practitioners who are employed in pediatric primary care within the health system. Four providers were used for the sample size, and the sample consisted of both MDs and NPs. Selection was somewhat purposive, as pediatric primary care is a unique specialty. The intervention was open to pediatric primary care providers who were attending a required all-staff meeting. The participants of the meeting were not required to participate in the intervention. The

researcher reviewed two charts per provider after the educational intervention; one retrospectively, prior to the education, and one after the education. The researcher targeted this specific group, as they often report a lack of resources and knowledge on the accurate assessment and management of patients who present with concussions (Arbogast et al., 2017; Hoffmeister et al., 2015; Lovell & Faizo, 2008; Scorza et al., 2012).

The researcher numbered the questionnaires and assigned each provider a number; however, no other identifying data was associated with that number. No promise of anonymity was made. The sample included MDs and NPs to help diversify the sample. The sample size was four pediatric primary care providers; two MDs and two NPs. The researcher provided education during an all-staff meeting and providers signed a statement of understanding and a consent form to participate in the project.

Setting

The project took place within a large health system in Southwest Florida. The researcher provided education at an all-staff meeting for providers. The researcher asked providers to participate during the all-staff meeting, but participation was completely voluntary. If providers decided to participate, the researcher asked providers to sign a consent form. As previously mentioned, almost universally, primary care providers feel as though they have limited knowledge and skill in accurately diagnosing and managing patients with concussions (Argobast et al., 2017). The University chair supported the project as well as the nursing research council (NRC) at the organization. The University Institutional Review Board and the institution's Institutional Review Council reviewed the project to ensure that the protection of the subjects' human rights remained a priority throughout the completion of the project. Additionally, a pediatrician within the system supported the project.

Tools

The researcher adopted the HEADS UP tool, published by the CDC and available on public domain. The screening form is a six-part questionnaire that examines the injury characteristics, symptoms, risk factors, red flags, diagnosis and follow-up plan. The form can be completed by an athletic trainer, NP, or MD, and based on the results, providers make recommendations for return to play and return to learn (CDC, 2017).

The researcher selected the HEADS UP primarily for its ease of use. The researcher reviewed other screening tools, such as the SCAT assessment tool; however, this tool relied heavily on subjective patient data and was quite long, demanding a lot of the providers' time.

In reviewing some of the literature regarding the HEADS UP tool, one study found that after an informal review of the tool, providers' knowledge regarding concussion screening did not change dramatically; however, providers did gain new knowledge regarding concussion management (Chrisman, Schiff & Rivara, 2011). Providers, after being informally educated on the HEADS UP tool were much more likely to be conservative with return to play and return to learn guidelines (Chrisman et al., 2011). The researchers in this study mailed providers a copy of the training, and providers completed it individually (Chrisman et al., 2011). The researchers in this study purposed that a more formal education of the screening tool and management protocol may allow for an increase in knowledge regarding concussion screening and management (Chrisman et al., 2011). In addition to the previously mentioned study, the researcher examined an article discussing expert opinion of primary care providers using the HEADS UP tool within clinical practice (Stump, 2007). Providers stated that although the tool was overall helpful, some limitations with it did exist (Stump, 2007). This provided good insight to the researcher on areas to target education to providers.

In addition to the HEADS UP tool, the researcher utilized a Likert-style questionnaire before and after the researcher provided education to assess providers' knowledge and comfort in assessing and managing concussions in the primary care setting. The questionnaire was 10 questions that are tied to a numerical answer, from zero being completely disagree, to seven being strongly agree, with two questions that were open ended for anecdotal comments. The questionnaire is included as an appendix within this document (Appendix G).

Since this questionnaire was developed by the student, it is understood that validity was limited; however, face validity was achieved by asking several professionals in the field, to review the tool prior to using it in the project. Although this limitation exists, the tool still displayed an impact of the education on the providers and the anecdotal responses gave direct feedback and allowed providers to expound more on how the education will impact their practice.

Intervention

The researcher utilized an oral Power Point presentation to deliver the education. Next, the researcher developed the questionnaire with 10 Likert-style questions and two open-ended questions for providers to take before and after the education to compare the results. Four providers agreed to participate in the study by completing the pre- and post-educational surveys. The researcher completed the education and reviewed one chart pre-intervention, and one chart post-intervention per provider to determine whether or not a change in practice occurred.

After the researcher developed and defended the proposal to the project chair, the researcher submitted the proposal to organization's Institutional Review Board and Nursing Research Council, who approved the proposal as well. The researcher then submitted the proposal to the University's Institutional Review Board for approval. Once all three entities

approved the proposal, the researcher provided education during an all-staff meeting, and addressed pediatric primary care providers in the form of an oral Power Point presentation. The researcher administered the pre-education survey prior to the education and administered the post-education survey immediately after the education. The education, pre- and post-tests took around 40 minutes to complete.

Team and Data Collection

The team involved in this project included the researcher, the project chair, and the pediatric primary care providers. The researcher obtained support for this project from the pediatrician within the practice (Appendix F). After all entities approved the project, education took around 40 minutes total for pre-education survey, education and post-education survey, however follow-up occurred two months after the researcher completed the education. The researcher collected data including the surveys of the providers, and the chart review for each provider. The researcher assigned each provider a number, but no provider identifiers were tied to the numbers. The researcher stored data on a password protected computer, which will be destroyed after three years.

Protection of Human Rights

The University Institutional Review Board evaluated and approved the project, as well as the organizational nursing research council and institutional review council. The researcher offered providers the option to participate in the project, but also notified providers that their participation would not affect their employment, as stated in the consent form. The researcher also completed Collective IRB Training Initiative (CITI) training prior to completing the project to ensure that basic human rights are preserved while carrying out the project, and a copy of this certificate of completion is included in the Appendix (Appendix B). In addition to the CITI

training required by the University, the organization required specific HIPAA training, which the researcher completed and attached as an Appendix (Appendix L).

Feasibility Analysis

The researcher performed a feasibility analysis prior to completing the project. Resources for completing this project included the project leader's personal computer, which utilized Power Point Software, SPSS Software for statistical analysis and Microsoft Word to draft the questionnaire. Personnel for this project included the researcher, the project chair, an editor for the manuscript of the project, and the primary care providers who were educated.

Budget

When considering the budget for this project, it remained neutral and the researcher handled all costs. The main costs for this project included printing the questionnaires, commuting to and from the clinic to provide education, and the cost of the statistical analysis program that was used for data analysis. All time to work on the project was taken out of the project leader's personal time, including meetings with the project chair, nursing research council, and providing the education.

Cost/Benefit Analysis

The researcher performed a cost-benefit analysis to identify the importance of using evidence-based concussion care in primary care. The cost to implement this evidence based screening tool and management approach in the primary care setting is minimal compared to the cost of a concussion.

Evaluation/Data Analysis

Objectives:

1. After completing the targeted education, primary care providers will demonstrate an increase in comfort and knowledge in accurately assessing, diagnosing and managing concussions in pediatric patients within the primary care setting as evidenced by an increase in scores on the concussion questionnaire.
2. After completing the targeted education, the primary care providers will begin to use the validated screening tool and management strategies in clinical practice, as evidenced by documentation in the EMR of the use of a validated screening tool within the clinical note for the visit. Two charts per provider will be reviewed at random two months after the education is complete. One chart will be retrospective, prior to the education, and one chart after the education was completed.

Objective 1: Impacting knowledge and comfort of pediatric primary care providers in assessing and managing concussions.

Method and design.

The researcher utilized a dependent, one group pre-test/post-test design to determine the impact that a targeted educational session had on the knowledge and comfort among pediatric primary care providers regarding the assessment and management of concussions.

Sample.

The sample consisted of primary care providers, including MDs and NPs. A nonrandom, purposive, convenience sample was used for this study. The researcher addressed providers during an all-staff meeting. Included as an Appendix (Appendix D) is the letter used to recruit the providers. Inclusion criteria included providers being an MD, NP or PA employed within the pediatric primary care sector in the system. Exclusion criteria included non-

providers, and those who chose not to participate. A total of four providers, including MDs and NPs agreed to participate.

Data collection/tool.

The researcher created both pre-education and post-education surveys (Appendix G). The surveys took 2-5 minutes to complete and providers completed surveys in writing prior to, and immediately following the education. Providers answered surveys with a Likert scale from 1, being strongly disagree, 4 being neutral to 7, being strongly agree. The researcher created a bar graph utilizing Microsoft Excel for both the pre-educational survey and the post-educational survey to determine how providers' responses to the questions changed.

Statistical analysis.

The dependent variable of interest was providers' knowledge of and comfort in assessing and managing concussions. The researcher presented this variable with a Likert scale from 1-7, 1 being strongly disagree, 4 being neutral, and 7 being strongly agree (Appendix G). The researcher entered the data from the surveys into Microsoft Excel and a created a bar graph to display the change in providers' knowledge and comfort regarding assessing and managing concussions after the targeted education was complete (Figures 2 and 3).

Objective 2: Primary care providers will start to use the HEADS UP tool within clinical practice and will adhere to the recommended management guidelines.

Method and design.

The researcher utilized a dependent, one group pre-test/post-test design to examine the impact targeted education to pediatric primary care providers has on the usage of the HEADS UP tool and management guidelines within clinical practice.

Sample.

The sample consisted of pediatric primary care providers, including MDs and NPs. The researcher used a nonrandom, purposive, convenience sample for this study. The researcher addressed providers during an all-staff meeting and invited providers to participate in the study. Included as an Appendix (Appendix E) is the letter used to recruit the providers. Inclusion criteria included providers being an MD, NP or PA employed within the pediatric primary care sector in the system. Exclusion criteria included non-providers, and those who chose not to participate. A total of four providers, including MDs and NPs agreed to participate.

Data collection/tool.

The researcher conducted a two month chart review post-intervention and pulled charts with the ICD-10 code of concussion, S06.0 (ICD10Data, 2018). The researcher reviewed one chart per provider retrospectively, prior to the education, and one chart per provider after the education. The project leader reviewed the documented note in the chart to determine: 1) if the providers were documenting using the HEADS UP tool, and 2) if the providers were using the recommended management guidelines. If the chart included both entities, the researcher deemed the chart compliant, if the chart included one of the two entities, the researcher deemed the chart partially complaint and if the chart included neither of the entities, the researcher deemed the chart non-compliant. The researcher de-identified all data and removed patient information to be compliant with HIPAA. The researcher stored information on a password protected computer and will destroy the data three years after the project has reached completion.

Statistical analysis.

After discussing the project with the project chair, the researcher utilized descriptive statistics. The descriptive statistics show whether or not providers were compliant, partially

compliant, or non-compliant in documenting using the HEADS UP tool and management approach.

Results

The researcher invited 15 providers to participate in this scholarly project with a total of four providers that agreed to participate, meeting the inclusion criteria. The researcher reviewed a total of eight charts, two months after the educational intervention took place. The researcher reviewed one chart per provider retrospectively, prior to the education, and one chart per provider after the education took place. Demographics of the primary care providers, sample size, assumptions, significant findings and a results summary are included here.

Demographics

Sample size. A total of four providers participated in this scholarly project (n=4). The researcher collected pre- and post-education survey data on all of the providers and reviewed two charts per provider for compliance in using the HEADS UP tool and management guidelines (n=8).

Type of healthcare profession. The sample included 2 MDs and 2 NPs who participated in this scholarly project; see Figure 1.

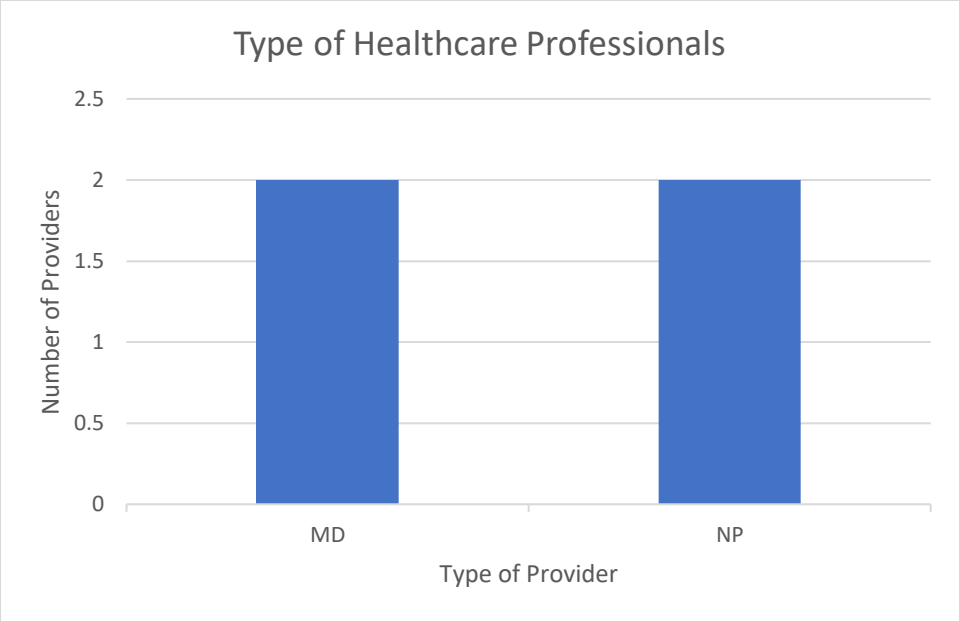

Figure 1. Type of Healthcare Professions

Assumptions

Assumptions for this scholarly project included that providers answered questions on the pre- and post-educational survey honestly and that the providers documented using the HEADS UP tool and management guidelines on their own volition.

Main Findings

The researcher found that four patients were diagnosed with a concussion by the participating providers between the educational intervention and the chart review that occurred 2 months afterword (see Table 1, Figure 1).

Table 1

HEADS UP Tool and Management Approach Use

HEADS UP Tool or Management Approach Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No Tool or Management Approach Use	5	62.5	62.5	62.5
	Managment Approach Use	2	25.0	25.0	87.5
	Tool and Management Approach Use	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

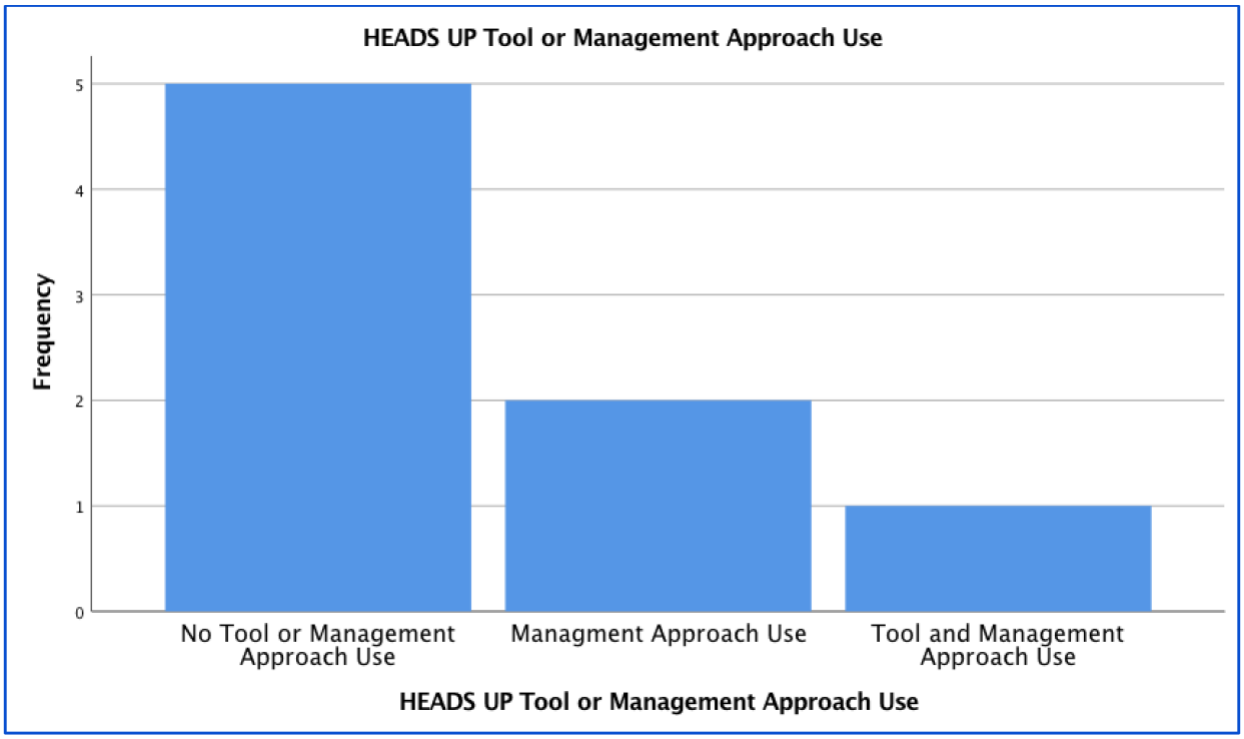

Figure 2. HEADS UP Tool and Management Approach Use

In addition to the chart review, the researcher conducted the survey before and after the targeted education (Appendix G). The survey took anywhere from 2-5 minutes to complete and was completed by the providers in writing. The researcher conducted the survey with a Likert scale, numbered 1 to 7, with 1 being strongly disagree, 4 being neutral and 7 being strongly

agree. The researcher entered data from the surveys into a Microsoft Excel sheet and created a bar graph to demonstrate the increase in the providers' knowledge and comfort in assessing and managing a pediatric patient with a concussion (Figures 3 and 4).

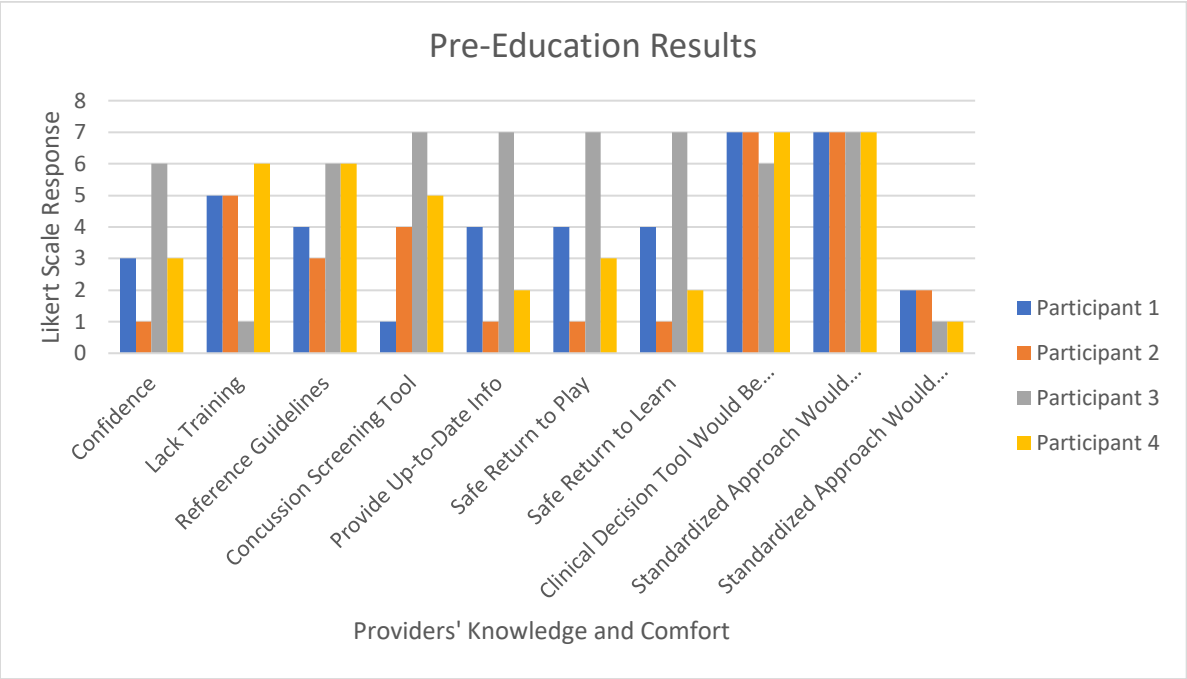

Figure 3. Pre-Education Survey Results

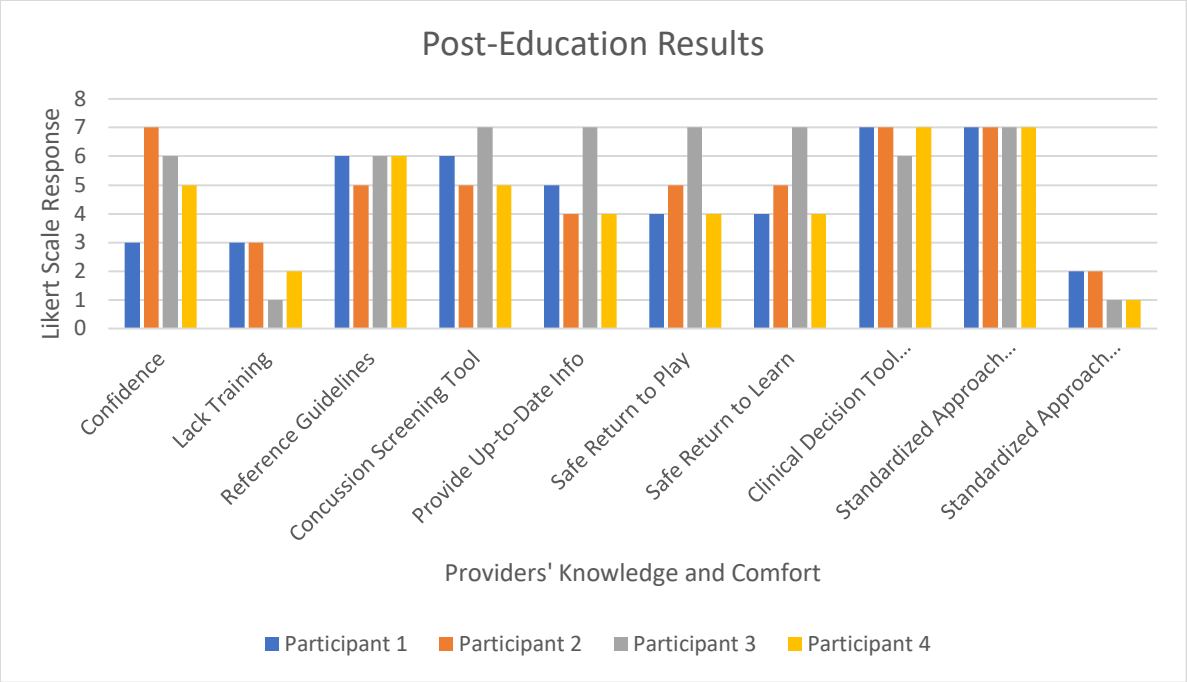

Figure 4. Post-Education Survey Results

In addition to the numeric values provided within the pre- and post-intervention survey, providers had the opportunity to provide open-ended responses to two questions. Questions are included in Appendix G. Below is a table that outlines the specific providers' responses to the open-ended questions for both the pre- and post-intervention surveys (Tables 2 and 3).

Table 2

Providers' Responses to Open-Ended Questions on Pre-Intervention Survey

Provider #	Question 1 Response	Question 2 Response
1	NPs are unable to clear patients for return to play in the state of Florida.	Most all of it, but I feel least confident about managing through the steps to return to learn/play.
2	The poor plan of care when not using a standardized approach.	Managing the return to play/return to learn.
3	Getting the patients better.	Arranging the right follow-up/management piece.
4	Determining the best follow-up/management plan.	Safely allowing them to return to play.

Table 3

Providers' Responses to Open-Ended Questions on Post-Intervention Survey

Provider #	Question 1 Response	Question 2 Response
1	Finding out about CDC guidelines!	I was not aware of the CDC guidelines, and now I will use them in clinical practice.
2	Very concise training – glad to know about this resource.	LOTS! I'm excited to have this resource so readily available.
3	Learning about the step-wise management approach.	How to appropriately manage patients based on symptom profile.
4	Very direct training – highlighted the most important aspects of caring for these patients.	Really enjoyed learning about the management approach.

Descriptive statistics. After running the descriptive statistics, 25% of the providers used the management approach solely, 12.5% of providers used the tool and management approach, and 62% of providers did not use the tool, or the management approach.

Summary of Results

The outcomes for this scholarly project were measured as follows: 1) increased knowledge and comfort among primary care providers when assessing and managing pediatric patients with a concussion, and 2) an increased use of the HEADS UP screening tool and management strategies within clinical practice.

Outcome 1. Increased knowledge and comfort of pediatric primary care providers in assessing and managing concussions. As evidenced by the responses to both the pre-education and post-education surveys (Figures 2 and 3), primary care providers felt that had more knowledge and were more comfortable regarding assessing and managing concussions

within the pediatric population. The main areas that increased were the knowledge regarding return to play and return to learn guidelines.

Outcome 2. Increased use of the HEADS UP screening tool and management strategies within clinical practice. The majority of providers did not choose to use the screening tool in clinical practice; however, some did choose to use the management recommendations in their clinical practice. Although there was not an overwhelming amount of participation, or significant change in clinical practice, some providers did use the management approach, which was more readily available for use in clinical practice. Interestingly enough, the only provider who used both the screening tool and management approach in clinical practice was a nurse practitioner. Perhaps the NP enjoyed the clinical practice guidelines presented and felt that it improved her practice.

Discussion

The purpose of this scholarly project was to determine the effectiveness of targeted education to pediatric primary care providers on the assessment and management of concussions, specifically using the HEADS UP tool, which is put forth by the CDC. Prior to the educational intervention, providers were largely using their own preferred screening tool and management approach, although there was a screening tool integrated into the EMR. The results of this project show that although there is not significant change in clinical practice, there is significance in the knowledge and comfort that providers feel regarding the assessment and management of concussions within this population, as demonstrated with the survey responses. The outcomes are mixed and point to further efforts with larger groups, and a longer post-intervention surveillance period for clinical care changes. The literature review conducted prior to completing this study documented a clear gap in knowledge among pediatric primary care providers when assessing

and managing a concussion and documented the benefits of using a standardized screening tool and management approach within clinical practice. Strengths, limitations, and implications for practice and research need to be reviewed prior to any replications of this study.

Strengths

Strengths of this project include its cost effectiveness and multiple methods of data collection. The cost of this project was minimal and required no grant or outside assistance. The multiple methods of data collection, including the survey results and chart reviews yielded a well-rounded project, which helped to reduce bias and add to the rigor of the study. The project was relatively easy to implement, as well, which will aid in its replication.

Limitations

Several limitations to this project exist. These limitations include the short time frame between education and chart review, sample size, response bias of providers, limited number of charts per providers with specific criteria for chart review and the HEADS UP tool not being readily available for documentation within the EMR. The two month time frame between educational intervention and chart review was not nearly enough to reveal a significant change within clinical practice. Providers had a response bias on their survey responses as they wanted to keep the project leader happy, which may have skewed some of the survey data results. In addition to this response bias, the short time frame between education and post-education survey only measured very short term learning, and may not correlate with behavior change, or knowledge retention long-term. Long-term knowledge or behavior change cannot be inferred. A larger sample size of providers would have yielded more results, as well. In addition to the limited sample size of providers, the sample size of charts was limited as well. The educational intervention was completed in June, and the chart review was completed in August. Perhaps

completing the education in late summer, before the start of the fall sports season would yield a larger sample size of charts to review. The final limitation of this study was the fact that the HEADS UP tool was not integrated within the EMR, easily accessible for the providers' use.

Implications for Practice

One of the outcomes for this project was to increase the knowledge and comfort among pediatric primary care providers in assessing and managing patients with concussions, and this was indicated by the post-education survey results. This indicates that targeted education and chart reviews are clinically beneficial to allow improved knowledge and comfort among primary care providers when assessing and managing concussion patients. The results of the process also indicate that this type of study can be replicated within the primary care setting to promote the use of evidence-based practice among providers.

Many primary care providers feel inadequate knowledge in the areas of assessing and managing patients with concussions. Using standardized screening tools and management approaches within the primary care setting limited the number of referrals to specialists, and decreased the burden of illness, especially related to cost of concussions. Beyond the realm of concussions, standardizing some practices within medicine can reduce cost and allow for a more timely and accurate diagnosis.

Implications for Research

Further research is indicated on this topic. Future research should be on a greater scale, with larger sample sizes in both provider number and chart review number. In addition to a larger sample size, a longer time period between educational intervention and chart review would help to bolster the results and the rigor of the study. Potentially, this project could be replicated

and consider the financial benefits of a concussion patient being able to stay within the realm of primary care, thus reducing the burden on specialists.

As this project was fairly easy to implement, it also could be replicated easily. In addition to its ease of implementation, it was cost effective, and perhaps, may be better received if the project leader was already integrated into the office staff, thus fostering more trust and allowing more providers to feel comfortable having their charts reviewed.

Dissemination Plan

Dissemination of project findings is very important to inform the participants of the results of the study and increase the awareness of pediatric primary care providers on the importance of standardized concussion screening and management. Goals for dissemination include educating the public on the benefits of standardizing concussion screening and management and on the benefits of using targeted education to providers and a chart review to increase the use of evidence-based practice within pediatric primary care.

Dissemination will be addressed by the researcher and will include sharing findings through a poster, and podium presentation to be used at conferences. The target audiences for these presentations will be physicians, nurses, nurse practitioners and physician assistants. The project will also be submitted to the University Digital Commons and will be available for search and download. Finally, a manuscript will be submitted to several professional journals for their review and, will ultimately hopefully be published within their publications.

Conclusion

Concussions are a timely and important topic, especially within the pediatric population. Despite pediatric primary care providers being trained specifically, they often report that they feel a lack of knowledge and resources to accurately assess, diagnose and manage a concussion

within their clinical practice. The purpose of this project was to increase the knowledge and comfort level of providers in assessing and managing concussions by providing a targeted education on the HEADS UP screening tool and management approach put forth by the CDC. The researcher reviewed charts, both retrospectively, and two months after the researcher provided the education to see if the providers started to utilize the tool and management approach within clinical practice. Although the researcher did not note a significant increase in the use of the screening tool and management approach, clinical significance increased as evidenced by the pre- and post-education survey responses. Further research in this area is recommended to see if other settings and providers would yield similar results.

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Appendix A

Literature Review Matrix

Citation	**Study Purpose**	**Sample (characteristics of the sample: demographics etc.)**	**Methods**	**Study Results**	**Level of Evidence**	**Study Limitations**	**Would use as evidence to support a change (yes or no) provide rationale**
Arbogast, K., Curry, A., Metzger, K., Kessler, R., Bell, J., Krupa, J., . . . Master, C. (2017). Improving primary care provider practices in youth concussion management. *Clinical Pediatrics*, 56(9), 854-865. Retrieved September 28, 2017.	To identify gaps in primary care concussion management, especially in the pediatric population	Sample included primary care providers who assessed and managed patients with concussions in their practice	Descriptive study	Study demonstrated a large volume of pediatric concussion patients entering the system through the ER, but also a large volume seeing primary care physicians.	Level 6	Limited to certain geographical areas, and focused heavily on ER providers as primary care providers	This study did demonstrate the burden of illness related to concussions in the pediatric population

Aukerman, D., Phillips, N., & Graham, C. (2016). Concussion management in the collegiate athlete. *Sports Medicine and Arthroscopy Review,*24(3), 130-133. Retrieved June 4, 2017.	Gaps in care were discussed, specifically regarding the return to play protocol and how it differs among many different institutions.	Systematic review of concussions within the collegiate athletic population.	Systematic Review	Recommendations for return to play guidelines following a stepwise and evidence-based approach were discussed. Also discussed was the importance of providers staying up to date on current evidence regarding concussion care to provide the best care to athletes.	Level 1	Slightly limited population	This is a good, strong study to use that demonstrates the need for evidence-based return to play guidelines in order to improve outcomes both physically and academically.
CDC. (2017). HEADS UP to Health Care Providers: Tools for Providers. Retrieved from https://www.cdc.gov/headsup/providers/tools.htm	The CDC's HEADS UP tool and management approach.	N/A	N/A	N/A	N/A	N/A	Used this tool and management approach to educate providers during an all-staff meeting.

Chin, E., Nelson, L., Barr, W., McCrory, P., & McCrea, M. (2016). Reliability and validity of the Sport Concussion Assessment Tool–3 (SCAT3) in high school and collegiate athletes. *American Journal of Sports Medicine*,44(9), 2776-2785. Retrieved June 4, 2017.	The SCAT-3 assessment tool was assessed for reliability and validity amongst high school and collegiate athletes.	Demographics such as sex, GPA, etc. were considered when conducting this study.	Cohort study based on the diagnosis of concussions.	Although in some scenarios, baseline testing would be helpful, it is not always necessary and does not hinder a patient's performance using SCAT-3 after an acute concussion.	Level 2	Slightly limited population due to geographical location.	This study identified a screening tool; however, it did highlight some limitations of the screening tool, but this tool is good and may be used to educate providers.
Chrisman, S., Schiff, M., & Rivara, F. (2011). Physician concussion knowledge and the effect of mailing the CDC's "Heads Up" toolkit. *Clinical Pediatrics*, 50(11), 1031-	Evaluated the effectiveness of educating primary care providers on the HEADS UP tool.	Sample included 414 primary care providers who were educated and surveyed on the HEADS UP tool.	Randomized control trial.	Results indicated that although practice among providers did not change significantly regarding the use of the tool, the providers did follow the management	Level 2: Randomized Control Trial.	Limited methods, including mailing out surveys. May have limited response from providers.	Does support the use of the HEAD UP tool and management approach within clinical practice. This was also a larger-scale study, which makes results more generalizable.

1039. Retrieved March 16, 2018.				recommendations.			
Coldren, R. L., Russell, M. L., Parish, R. V., Dretsch, M., & Kelly, M. P. (2012). The ANAM lacks utility as a diagnostic or screening tool for concussion more than 10 days following injury. *Military Medicine*, 177(2), 179-183.	Assessing concussion management in soldiers overseas within 1 week of injury.	Soldiers overseas injured in combat, within one week of their injury.	Controlled trial, no randomization; purposive sampling within the military base	A wide variety exists within the military's treatment of individuals with concussions, leading to varied outcomes.	Level 3: Controlled Trial	Limited population	Does support the need for more streamlined concussion assessment and management.
Davis, G. A., Anderson, V., Babl, F. E., Gioia, G. A., Giza, C. C., Meehan, W., . . . Zemek, R. (2017). What is the difference in concussion management in children as compared with adults? A systematic review. *British Journal of*	A systematic review to determine the differences in pediatric concussion management versus adult concussion management	Studies were reviewed regarding children ages 5-18 with the diagnosis of a concussion	Systematic review	Age-appropriate guidelines should be applied when assessing and managing patients with concussions	Level 1	Very widespread systematic review, very few limitations identified.	A great study to demonstrate the need for age-appropriate assessment and management techniques in concussions.

Sports Medicine, 51(12), 949-957.							
Esquivel, A., Haque, S., Keating, P., Marsh, S., & Lemos, S. (2013). Concussion management, education, and return-to-play policies in high schools: A survey of athletic directors, athletic trainers, and coaches. *Sports Health: A Multidisciplinary Approach*, 5(3), 258-262.	Assessing concussion knowledge and assessment skills among coaches and athletic trainers and assessing the need for education among these individuals.	Polling athletic trainers and coaches on their knowledge of assessing concussions on the field immediately after injury.	Single descriptive study	Certain sports, including soccer had less concussion awareness than sports like football and the areas for education and improvement were identified.	Level 6	Answers from participants were highly anecdotal, which leaves room for misinterpretation from researchers.	This is a good study to keep in mind, as athletic trainers and coaches are typically the first to assess athletes and make the referral to primary care.
Gillooly, D. (2016). Current recommendations on management of pediatric concussions. *Pediatric Nursing*, 42(5), 217-222.	This expert review outlined the current trends in management for pediatric concussions	This was purely expert opinion, however, it outlined important trends in the manageme	Expert Opinion	Pediatric concussions go largely underdiagnosed, and adequate training needs to be provided to primary care providers	Level 6	Although this was largely expert opinion, it was helpful in identifying current concussion screening and management strategies that are important in the pediatric population	This will be used to help develop an education plan for primary care providers on screening tools and management approaches

Retrieved September 28, 2017.		nt of pediatric concussions		on the assessment and management of concussions to improve patient outcomes			
Graves, J., & Klein, T. (2016). The impact of patient characteristics on nurse practitioners' assessment and management of adolescent concussion. Journal of the *American Association of Nurse Practitioners*,29, 136-148. Retrieved June 4, 2017.	This study used a series of videos of patients acting out various scenarios in which a concussion was sustained. The NPs had to identify the injury and use a Likert-scale to determine return to play and other management topics of concussion injuries	Sample included primary care nurse practitioners from Oregon and Washington	Randomized Control Trial	Although most NPs did well at diagnosing a concussion, management strategies, specifically return to play guidelines varied widely among providers.	Level 2	Limited study geographically, but otherwise a well-conducted study	The study pleaded for more education for NPs, since they have the authority to diagnose and manage concussions.
Guskiewicz, K. M., Bruce, S. L., Cantu, R. C., Ferrara, M. S., Kelly, J. P.,	Recommendations for the initial management of an athlete	Focuses on the athletic trainer and provides	Expert Opinion	Detailed management suggestions based on expert	Level 7	Limited scope, as the expert opinion only applies to athletic trainers	Good initial management protocol, with very detailed return to play guidelines – could be helpful in

Mccrea, M., . . . Mcleod, T. C. (2004). Recommendations on management of sport-related concussion: Summary of the National Athletic Trainers' Association position statement. *Neurosurgery*, 55(4), 891-896.	with a concussion by an athletic trainer.	screening, management and follow-up strategies for concussion patients		opinion, however recommendations cover a broad area of topics including evaluation, severity, return-to-play decision and home care.			developing return to play guidelines to teach providers
Hoffmeister, E. (2015). Preliminary Findings on consistency, validity of a concussion screening tool. *The Newsletter on Musculoskeletal Medicine*,21(3), 24-32. Retrieved June 4, 2017.	Study examined symptoms related to having a concussion, including vestibular and motor deficiencies and how they played into a person's susceptibility to post-concussion syndrome	Sample was adults, age 18 and older, which can still include college-level athletes	Cross-Sectional Study	Vestibular and motor deficits present upon initial concussion screening are a good predictor for post-concussion syndrome.	Level 2	Slightly small sample size of only 64 participants	This study helps to demonstrate the variability among providers when assessing and managing concussions
Karlin, A. (2011).	Expert opinion on	Expert opinion,	Expert Opinion	Pediatric patients with	Level 6	Limited, as far as strictly being expert	This article will be used in the background section to

Concussion in the pediatric and adolescent population: "Different population, different concerns". *American Academy of Physical Medicine and Rehabilitation*, 3, 369-379. Retrieved September 28, 2017.	the differences between pediatric concussion and adult concussion	however highlights very important aspects of concussion screening and management within the pediatric population		concussions present much differently than adults with concussions and should be assessed and managed differently		opinion, however it highlights the important role of the primary care provider in assessment and management of patients with concussions	highlight the differences of pediatric patients with concussions
Kostyun, R. O., Milewski, M. D., & Hafeez, I. (2014). Sleep Disturbance and neurocognitive function during the recovery from a sport-related concussion in adolescents. *The American Journal of Sports Medicine*, 43(3), 633-640.	Testing was done at a sports medicine clinic to help determine how sleep dysfunction affected an athlete's potential for developing post concussive syndrome	The sample was athletes who sustained a concussion, more specifically adolescent athletes	Cross-Sectional Study	Findings showed that concussion patients who perceived some kind of sleep disturbance after their concussion may report a higher number of symptoms after their injury	Level 3	This was a well conducted study that had very few limitations	This would be good to use in education to providers to alert them that if sleep disturbance was perceived by the patient, a higher number of symptoms may be reported

Lovell, M. R., & Fazio, V. (2008). Concussion management in the child and adolescent athlete. *Current Sports Medicine Reports*, 7(1), 12-15.	Assessing current management of pediatric concussion patients and making recommendations for future practice.	Expert opinion on current management practices for pediatric athletes with concussions and recommendations for future practice.	Purely expert opinion	Gave some recommendations for assessing smaller children; as tools are developed, their reliability and validity need to be tested; addressed need for family assessment when determining return-to-play decision.	Level 7	Although the level of evidence is not very high, the expert opinion helps to identify current trends in concussion management	This will also be used in the background section of the paper and will further demonstrate needs for increased education among providers.
Mccrea, M. (2001). Standardized mental status assessment of sports concussion. *Clinical Journal of Sport Medicine*, 11(3), 176-181.	Utilizing a standardized screening tool both at the time of injury and 48 hours after injury to determine neurologic deficits of concussion.	Sport-related concussion patients were assessed with a validated screening tool at the time of injury and 48 hours after the injury, which	Single Control Trial with no randomization	Using the tool, deficits were not generally seen until 48 hours after the injury, typically the time when a primary care provider would be seeing an athlete.	Level 3	Very few limitations – very well-conducted study	This is an important study as it highlights some of the latent symptoms of a concussion that a primary care provider will need to assess

		highlights some of the latent symptoms of a concussio n.					
Nolin, P., Stipanicic, A., Henry, M., Joyal, C. C., & Allain, P. (2012). Virtual reality as a screening tool for sports concussion in adolescents. *Brain Injury*, 26(13-14), 1564-1573.	Utilizing virtual reality tool to identify the deficits from a concussion sooner than neuropsychol ogical tests that are typically administered on the sidelines after an athlete sustains a concussion.	Purposive sampling with a slightly small sample size	Single Control Trial with no randomiz ation	Although the virtual test did show some differences from the standard tests, it could not be determined whether these findings were significant enough, however it did provide an opportunity for further research.	Level 3	Small sample size limited to one athletic camp, however well-conducted	This provides information on the virtual reality concussion screening tests, however does not yield significant results that virtual reality testing is better than other screening tools.
Reisner, A., Burns, T. G., Hall, L. B., Jain, S., Weselman, B. C., Grauw, T. J., . . . Chern, J. J. (2017). Quality improvement in concussion care: Influence of	Education was provided to primary care providers on concussion assessment and management.	The sample was 120 pediatric primary care providers who were surveyed prior to and after	Cohort Study	Knowledge and comfort of the primary care providers increased significantly after the education regarding concussions.	Level 2	Slightly small and limited sample	This study is a good example of the importance of educating primary care providers on concussion management.

guideline-based education. *The Journal of Pediatrics*,184, 26-31.		the education on their knowledge and comfort in managing concussions.					
Resch, J. E., & Kutcher, J. S. (2015). The acute management of sport concussion in pediatric athletes. *Journal of Child Neurology*, 30(12), 1686-1694.	Physician reviews current management techniques for athletes with concussions including screenings to be conducted preparticipation, preseason, acutely and after an injury.	Purely expert opinion from a physician discussing appropriate times to screen athletes for concussions	Expert Opinion	Very detailed management guidelines, including the outline of several different concussion screening tools and each's limitations, strengths and implications for use.	Level 7	Although this is only expert opinion, this is a very thorough summary of recommendations for pediatric concussion management	This information is useful in the management section of the paper
Scorza, K., Raleigh, M., & O'Connor, F. (2012). Current concepts in concussion: evaluation and management. *American Family Physician*, 85(2)	Expert opinions by family practice providers on the screening and management guidelines for	Strictly expert opinion, however very good management strategies are included	Expert Opinion	Very detailed screening and management strategies, however also implications for further education and research for family	Level 7	Good information on management strategies from a family practice perspective, and also highlights the need for more education in the family practice arena	Will definitely use this to demonstrate the need for the project to be completes

, 121-132. Retrieved September 28, 2017.	concussion patients	within the publication		practice providers is demonstrated			
Seidman, D. H., Burlingame, J., Yousif, L. R., Donahue, X. P., Krier, J., Rayes, L. J., . . . Shaw, M. K. (2015). Corrigendum to "Evaluation of the King–Devick test as a concussion screening tool in high school football players". *Journal of the Neurological Sciences,* 358(1-2), 540.	Determining whether or not the KD test is an adequate concussion screening tool.	Descriptive study with purposive sampling in a single state	Descriptive Study	The test proved to be valid and sensitive in identifying individuals with concussions.	Level 6	This study shows one type of validated concussion screening tool.	Depending on the needs of the organization, this screening tool may be used to provide education to primary care providers.
Stache, S., Howell, D., & Meehan, W. (2016). Concussion management practice patterns among sports medicine physicians. *Clinical Sports Medicine,*26(5),	A large study among providers to determine who uses clinical guidelines when evaluating and treating concussions.	Sample is somewhat limited to members of a certain association, however is large-scale which	Randomized Control Trial	Many providers who were members of this certain association do use evidence based guidelines when assessing and managing concussions.	Level 2	This study outlines the importance of using evidence-based guidelines to screen for and treat concussions.	Will use this within the project to demonstrate the need for evidence-based management strategies.

381-385. Retrieved June 4, 2017.		yields generaliza bility.					
Stone, M. E., Safadjou, S., Farber, B., Velazco, N., Man, J., Reddy, S. H., . . . Teperman, S. (2015). Utility of the Military Acute Concussion Evaluation as a screening tool for mild traumatic brain injury in a civilian trauma population. *Journal of Trauma and Acute Care Surgery,* 79(1), 147-151.	Determining the efficacy of the MACE concussion screening tool in a military hospital in adult patients age 18-65.	Sample was with the adult population but was conducted in an ED during a specific time frame.	Randomi zed Control Trial	Findings displayed that the screening tool was useful, however researchers suggested that it should not be used alone in diagnosing or managing individuals with a concussion.	Level 2	Slightly limited sample due to geographic and time constraints	Helps to display the need for a validated screening tool in diagnosing a concussion.
Stump, E. (2007). CDC releases new "Heads Up" toolkit on concussions. *Ne urology Today*,7. Retrieved March 16, 2018.	Expert opinion on the use of the HEADS UP tool within clinical practice	Strictly expert opinion	Expert Opinion	Good insight from providers on how the tool was “much needed” in clinical practice; however, the article also	Level 7	Expert opinion discussing the use of the HEADS UP tool within clinical practice limits the generalizability of this article.	Good information on several barriers to address while using the HEADS UP tool within clinical practice.

				listed several limitations to using the tool in clinical practice.			
Tator, C. H. (2013). Concussions and their consequences: Current diagnosis, management and prevention. , 185(11), 975-979.	Detailed and thorough recommendations for providers, including a step-wise re-introduction to activity, long-term complications of concussions and resources that may be useful to providers.	Strictly expert opinion	Expert Opinion	Great information and resources for providers to use, especially on educating patients, primary, secondary and tertiary prevention of concussions and re-introducing activity.	Level 7	Expert opinion among primary care providers limits the generalizability of this study.	Good information to use in the background of the paper

Appendix B

CITI Certificate

CITI PROGRAM

Completion Date 29-Jun-2016
Expiration Date 29-Jun-2019
Record ID 17531277

This is to certify that:

Kaitlyn Mallon

Has completed the following CITI Program course:

Human subject - Basic (Curriculum Group)
Nursing (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Liberty University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wb48e0903-61b1-4be3-8969-8c5776ab0214-17531277

Appendix C

Permission to Use Iowa Model

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care*. Click the link below to open.

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

Copyright is retained by University of Iowa Hospitals and Clinics. **Permission is not granted for placing on the internet.**

Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

In written material, please add the following statement:
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[redacted] with questions.

Appendix D

Permission to Use HEADS UP Tool

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Appendix E

Recruitment Letter

November 22, 2017

Dear Participant:

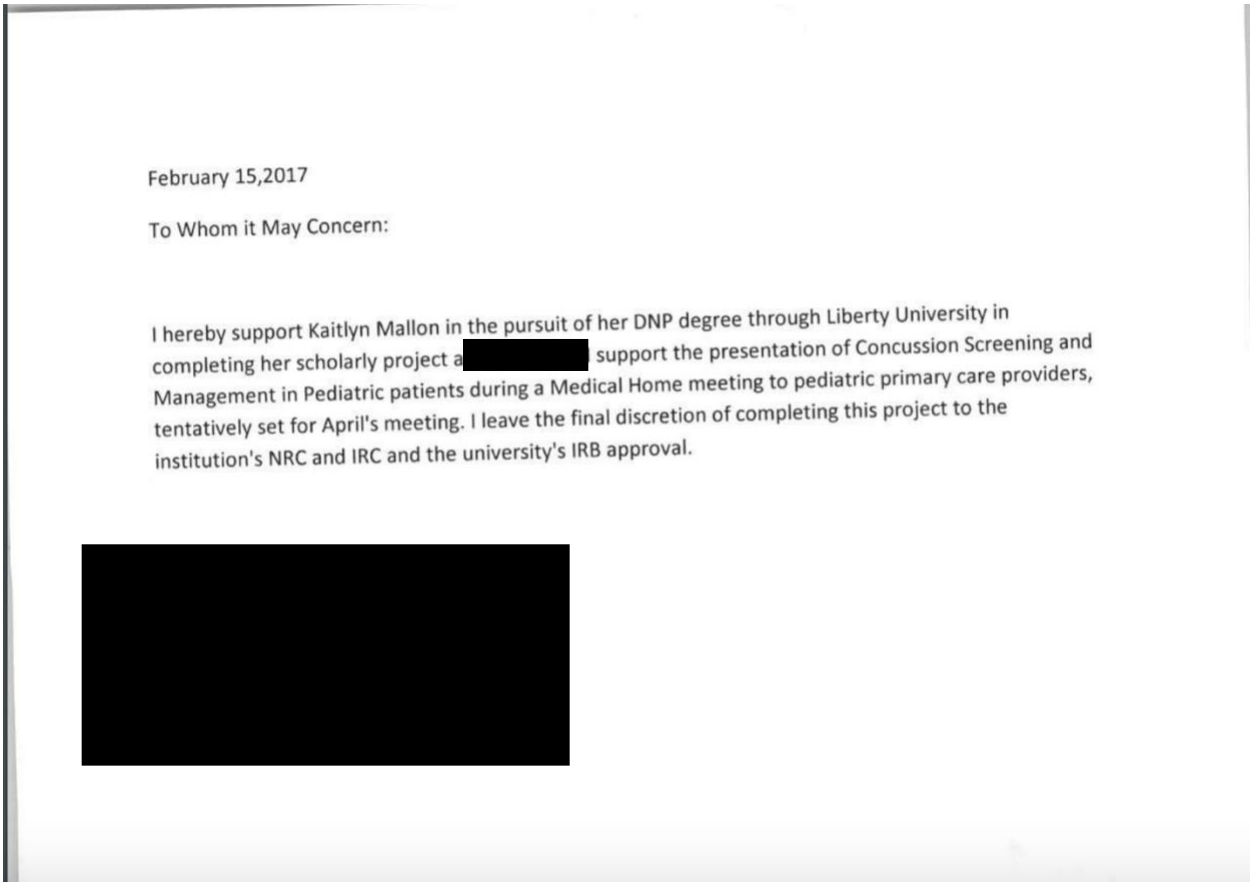
Thank you so much for attending this voluntary education on the assessment and management of patients with concussions in the primary care arena. Attached to this form, you will find a pre-education and a post-education survey. Please fill these out at your leisure and return them at the end of the session. By completing the survey, you are consenting to be an anonymous participant in a Doctoral Scholarly Project through [redacted] in partnership with [redacted] Thank you for your willingness to help better the outcomes of the patients that we serve on a daily basis.

Sincerely,

Kaitlyn Layman, BSN, RNC- NIC

Appendix F

Pediatrician/Organizational Letter of Support



February 15,2017

To Whom it May Concern:

I hereby support Kaitlyn Mallon in the pursuit of her DNP degree through Liberty University in completing her scholarly project a [redacted] support the presentation of Concussion Screening and Management in Pediatric patients during a Medical Home meeting to pediatric primary care providers, tentatively set for April's meeting. I leave the final discretion of completing this project to the institution's NRC and IRC and the university's IRB approval.

[redacted]

Appendix G

Pre/Post-Education Survey

This survey is numbered from 1-50 to help the participants remain anonymous and will be used for data-collection purposes only.

Please rate your level of agreement with the following statements regarding concussions:

	1 Strongly Disagree	2 Disagree	3 Somewhat Disagree	4 Neutral	5 Somewhat Agree	6 Agree	7 Strongly Agree
1. I feel confident in my training on the evaluation of a patient with a concussion.							
2. I feel as though I lack training in managing a patient with a concussion.							
3. I frequently reference clinical guidelines, current recommendations or medical literature when treating a patient with a concussion.							
4. I use a concussion screening tool regularly in my clinical practice.							
5. I feel confident that I provide the most up-to-date management for patients with a concussion.							
6. I feel confident that I prescribe safe return to play guidelines for athletes with concussions. (Physical activity)							
7. I feel confident that I prescribe safe return to learn guidelines. (Cognitive activity)							
8. I think a clinical decision tool would be helpful to assist in the assessment and management of patients with concussions.							
9. I believe that a standardized approach to assessing and managing concussion patients will be beneficial to patients and providers.							
10. I believe that a standardized approach to assessing and managing concussion patients will be cumbersome and a burden to providers.							

Open Ended Questions:

11. Which area of handling this patient population do you find most difficult?

12. Which aspect of managing these patients do you feel the least confident about?

This survey is numbered from 1-50 to help the participants remain anonymous and will be used for data-collection purposes only.

Please rate your level of agreement with the following statements regarding concussions:

	1 Strongly Disagree	2 Disagree	3 Somewhat Disagree	4 Neutral	5 Somewhat Agree	6 Agree	7 Strongly Agree
1. I feel confident in my training on the evaluation of a patient with a concussion.							
2. I feel as though I lack training in managing a patient with a concussion.							
3. I frequently reference clinical guidelines, current recommendations or medical literature when treating a patient with a concussion.							
4. I use a concussion screening tool regularly in my clinical practice.							
5. I feel confident that I provide the most up-to-date management for patients with a concussion.							
6. I feel confident that I prescribe safe return to play guidelines for athletes with concussions. (Physical activity)							
7. I feel confident that I prescribe safe return to learn guidelines. (Cognitive activity)							
8. I think a clinical decision tool would be helpful to assist in the assessment and management of patients with concussions.							
9. I believe that a standardized approach to assessing and managing concussion patients will be beneficial to patients and providers.							
10. I believe that a standardized approach to assessing and managing concussion patients will be cumbersome and a burden to providers.							

Open Ended Questions:

11. Which area of the training did you enjoy most?

12. What did you learn from the training?

Appendix H

University IRB Approval

[redacted]

May 31, 2018

Kaitlyn Layman
IRB Approval 3253.053118: Concussion Evaluation and Management Among Pediatric Patients in Primary Care

Dear Kaitlyn Layman,

We are pleased to inform you that your study has been approved by the [redacted] IRB. This approval is extended to you for one year from the date provided above with your protocol number. If data collection proceeds past one year, or if you make changes in the methodology as it pertains to human subjects, you must submit an appropriate update form to the IRB. The forms for these cases were attached to your approval email.

Thank you for your cooperation with the IRB, and we wish you well with your research project.

Sincerely,

[redacted]

Appendix I

Institutional IRB Approval

[redacted]

Institutional Review Committee

[redacted]

IORG# 0000442
FWA# 00000167
Registration# IRB00000752

May 10 ,2018

Kaitlyn Mallon, RN

VIA EMAIL

RE: CONCUSSION EVALUATION AND MANAGEMENT AMONG PEDIATRIC PATIENTS IN PRIMARY CARE

The [redacted] Institutional Review Committee met on May 2, 2018. At that meeting the Committee reviewed your request for approval of the above-mentioned protocol, data collection form, informed consent form and request for waiver of authorization and informed consent forms.

The [redacted] IRC office has received your revised protocol dated 8-2017, data collection form and revised consent form addressing the committee's request for clarifications.

After review and consideration of the information provided, the Committee has voted to approve this protocol for a period of one year from 5-2-2018 through 5-1-2019. If this protocol is to be continued for more than one year, please remember to request yearly reapproval from this committee. Enclosed you will find your approved informed consent form with the stamp that states [redacted]. Please make copies of the original, stamped informed consent form and use these copies for subjects you enroll into this protocol. The original approved consent form should be placed in your study binder and may be used to make additional copies as needed.

This study is to be conducted within a [redacted] As a condition of approval, [redacted] requires that a copy of the signed and dated subject consent form be placed in the subject's medical record. This consent should be placed in the subject's medical record prior to any registry enrollment, device/ implant surgery, before any experimental medication is given to the subject (if applicable) or prior to any study related participation from the patient.

The [redacted] Institutional Review Committee policy requires reporting of any serious or unexpected adverse event within five days of discovery. This Committee must approve any protocol, informed consent, or research activity changes prior to their implementation. Please be reminded that study renewal is due annually and a final report is required upon study completion. While investigators are sent notices regarding continuing review, it is ultimately the responsibility of the investigator to submit the required information to the committee in sufficient time for review before approval expiration.

The Principal Investigator (PI) is ultimately responsible for the conduct of the research, including ensuring that an investigation is conducted according to the approved protocol and the applicable regulations. The PI is also responsible for protecting the rights, safety, and welfare of the subjects under the investigator's care.

Sincerely,

Appendix J

HEADS UP Tool

ACUTE CONCUSSION EVALUATION (ACE)

[redacted]

Patient Name_____
DOB: _____ Age:_____
Date:_____ ID/MR#_____

A. Injury Characteristics Date/Time of Injury_____Reporter: __Patient __Parent __Spouse __Other_____

1. Injury Description _____

1a. Is there evidence of a forcible blow to the head (direct or indirect)? __Yes __No __Unknown
1b. Is there evidence of intracranial injury or skull fracture? __Yes __No __Unknown
1c. Location of Impact: __Frontal __Lft Temporal __Rt Temporal __Lft Parietal __Rt Parietal __Occipital __Neck __Indirect Force
2. **Cause:** __MVC __Pedestrian-MVC __Fall __Assault __Sports (specify)_____Other_____
3. **Amnesia Before (Retrograde)** Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? __Yes __No Duration_____
4. **Amnesia After (Anterograde)** Are there any events just AFTER the injury that you/ person has no memory of (even brief)? __Yes __No Duration_____
5. **Loss of Consciousness:** Did you/ person lose consciousness? __Yes __No Duration_____
6. **EARLY SIGNS:** __Appears dazed or stunned __Is confused about events __Answers questions slowly __Repeats Questions __Forgetful (recent info)
7. **Seizures:** Were seizures observed? No__ Yes___ Detail_____

B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes). **Lovell & Collins, 1998 JHTR*

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
Headache	0 1	Feeling mentally foggy	0 1	Drowsiness	0 1
Nausea	0 1	Feeling slowed down	0 1	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 1	Sleeping more than usual	0 1 N/A
Balance problems	0 1	Difficulty remembering	0 1	Trouble falling asleep	0 1 N/A
Dizziness	0 1	COGNITIVE Total (0-4) _____		SLEEP Total (0-4) _____	
Visual problems	0 1	EMOTIONAL (4)			
Fatigue	0 1	Irritability	0 1		
Sensitivity to light	0 1	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10) _____		EMOTIONAL Total (0-4) _____			
(Add Physical, Cognitive, Emotion, Sleep totals) Total Symptom Score (0-22) _____					

Exertion: Do these symptoms worsen with:
Physical Activity __Yes __No __N/A
Cognitive Activity __Yes __No __N/A

Overall Rating: How different is the person acting compared to his/her usual self? (circle)
Normal 0 1 2 3 4 5 6 Very Different

C. Risk Factors for Protracted Recovery (check all that apply)

Concussion History? Y___ N___	√	Headache History? Y___ N___	√	Developmental History	√	Psychiatric History
Previous # 1 2 3 4 5		Prior treatment for headache		Learning disabilities		Anxiety
Longest symptom duration Days__ Weeks__ Months__ Years__		History of migraine headache __ Personal __ Family_____		Attention-Deficit/ Hyperactivity Disorder		Depression
						Sleep disorder
If multiple concussions, less force caused reinjury? Yes__ No__				Other developmental disorder_____		Other psychiatric disorder _____

List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures)_____

D. RED FLAGS for acute emergency management: Refer to the emergency department with sudden onset of any of the following:

- * Headaches that worsen
- *Seizures
- * Focal neurologic signs
- * Looks very drowsy/ can't be awakened
- * Repeated vomiting
- * Slurred speech
- * Can't recognize people or places
- * Increasing confusion or irritability
- * Weakness or numbness in arms/legs
- * Neck pain
- * Unusual behavioral change
- * Change in state of consciousness

E. Diagnosis (ICD-10): __Concussion w/o LOC S06.0X0A __Concussion w/ LOC S06.0X1A __Concussion (Unspecified) S06.0X9A __Other (854)_
__No diagnosis

F. Follow-Up Action Plan **Complete *ACE Care Plan* and provide copy to patient/family.**

___ **No Follow-Up Needed**
___ **Physician/ Clinician Office Monitoring**: Date of next follow-up _____
___ **Referral:**
___ Neuropsychological Testing
___ Physician: Neurosurgery____ Neurology____ Sports Medicine____ Physiatrist____ Psychiatrist____ Other_____
___ Emergency Department

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

[redacted]

A concussion (or mild traumatic brain injury (MTBI)) is a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural injury, and is typically associated with normal structural neuroimaging findings (i.e., CT scan, MRI). Concussion may or may not involve a loss of consciousness (LOC). Concussion results in a constellation of physical, cognitive, emotional and sleep-related symptoms. Symptoms may last from several minutes to days, weeks, months or even longer in some cases.

ACE Instructions

The ACE is intended to provide an evidence-based clinical protocol to conduct an initial evaluation and diagnosis of patients (both children and adults) with known or suspected MTBI. The research evidence documenting the importance of these components in the evaluation of an MTBI is provided in the reference list.

A. Injury Characteristics:

1. Obtain **description of the injury** - how injury occurred, type of force, location on the head or body if force transmitted to head. Different biomechanics of injury may result in different differential symptom patterns (e.g., occipital blow may result in visual changes, balance difficulties).

2. Indicate the **cause of injury**. Greater forces associated with the trauma are likely to result in more severe presentation of symptoms.

3/ 4. **Amnesia:** Amnesia is defined as the failure to form new memories. Determine whether amnesia has occurred and attempt to determine length of time of memory dysfunction – before (retrograde) and after (anterograde) injury. Even seconds to minutes of memory loss can be predictive of outcome. Recent research has indicated that amnesia may be up to 4-10 times more predictive of symptoms and cognitive deficits following concussion than is LOC (less than 1 minute).[1]

5. **Loss of consciousness (LOC)** - If occurs, determine length of LOC.

6. **Early signs.** If present, ask the individuals who know the patient (parent, spouse, friend, etc) about specific signs of the concussion/ MTBI that may have been observed. These signs are typically observed early after the injury.

7. Inquire whether **seizures** were observed or not.

B. Symptom Checklist: [2]

1. Ask patient (and/ or parent, if child) to report presence of the four categories of symptoms since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury.[3] Record 1 for Yes or 0 for No for their presence or absence, respectively.

2. For all symptoms, indicate presence of symptoms as experienced within the past 24 hours. Since symptoms can be present premorbidly/at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from their typical presentation.

3. **Scoring**: Sum total number of symptoms present per area, and sum all four areas into Total Symptom Score (score range 0-22). (Note: most sleep symptoms are only applicable after a night has passed since the injury. Drowsiness may be present on the day of injury.) If symptoms are new and present, there is no lower limit symptom score. Any score > 0 indicates positive symptom history.

4. **Exertion:** Inquire whether any symptoms worsen with physical (e.g., running, climbing stairs, bike riding) and/or cognitive (e.g., academic studies, multi-tasking at work, reading or other tasks requiring focused concentration) exertion. Clinicians should be aware that symptoms will typically worsen or re-emerge with exertion, indicating incomplete recovery. Over-exertion may protract recovery.

5. **Overall Rating:** Determine how different the person is acting from their usual self. Circle 0 (Normal) to 6 (Very Different).

C. Risk Factors for Protracted Recovery: Assess the following risk factors as possible complicating factors in the recovery process.

1. **Concussion history:** Assess the number and date(s) of prior concussions, the duration of symptoms for each injury, and whether less biomechanical force resulted in re-injury. Recent research indicates that cognitive and symptom effects of concussion may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent concussion (which may indicate incomplete recovery from initial trauma).[4-8]

2. **Headache history:** Assess personal and/or family history of diagnosis/treatment for headaches. Recent research indicates headache (migraine in particular) can result in protracted recovery from concussion.[8-11]

3. **Developmental history**: Assess history of learning disabilities, Attention-Deficit/Hyperactivity Disorder or other developmental disorders. Recent studies indicate the possibility of a longer period of recovery with these conditions.[12]

4. **Psychiatric history**: Assess for history of depression/mood disorder, anxiety, and/or sleep disorder. [13-16]

D. Red Flags: The patient should be carefully observed over the first 24-48 hours for these serious signs. Red flags are to be assessed as possible signs of deteriorating neurological functioning. Any positive report should prompt strong consideration of referral for emergency medical evaluation (e.g. CT Scan to rule out intracranial bleed or other structural pathology).[17]

E. Diagnosis: The following ICD-10 diagnostic codes may be applicable.

S06.0X0A (Concussion, with no loss of consciousness) – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); no evidence of LOC (A5), skull fracture or intracranial injury (A1b).

S06.0X1A (Concussion, with brief loss of consciousness < 30 minutes) - Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); positive evidence of LOC (A5), skull fracture or intracranial injury (A1b).

S06.0X9A (Concussion, unspecified) - Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture or intracranial injury.

Other Diagnoses – If the patient presents with a positive injury description and associated symptoms, but additional evidence of intracranial injury (A 1b) such as from neuroimaging, a moderate TBI and the diagnostic category of **S06.890A (Intracranial injury)** should be considered.

F. Follow-Up Action Plan: Develop a follow-up plan of action for symptomatic patients. The physician/clinician may decide to (1) monitor the patient in the office or (2) refer them to a specialist. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon many factors (e.g., cognitive/ physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition. (Physician/clinician should also complete the ACE Care Plan included in this tool kit.)

1. **Physician/clinician serial monitoring**- Particularly appropriate if number and severity of symptoms are steadily decreasing over time and/or fully resolve within 3-5 days. If steady reduction is not evident, referral to a specialist is warranted.

2. **Referral to a specialist** – Appropriate if symptom reduction is not evident in 3-5 days, or sooner if symptom profile is concerning in type/severity.
   - Neuropsychological Testing can provide valuable information to help assess a patient's brain function and impairment and assist with treatment planning, such as return to play decisions.
   - Physician Evaluation is particularly relevant for medical evaluation and management of concussion. It is also critical for evaluating and managing focal neurologic, sensory, vestibular, and motor concerns. It may be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.

Appendix K

Institutional HIPAA Module Certificate