DEVELOPMENT OF AN EDUCATION MODULE ON CONCUSSIONS IN YOUTH
FOR PRIMARY CARE NURSE PRACTITIONERS IN UTAH

by

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As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Craig Nuttall entitled “Development of an Education Module on Concussions in Youth for Primary Care Nurse Practitioners in Utah” and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

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

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STATEMENT BY AUTHOR

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SIGNED: Craig Nuttall____________________
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DEDICATION

This manuscript is dedicated to my wife Kristin and my 6 children Nathan, Annie, Luke, Audrey, William and Claire. Without you I would not be who I am today. You motivate me, encourage me, and remind me to be the best that I can be. I want each of you to know that with hard work you can do anything.
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ABSTRACT

**Background:** Sports-related concussions (SRC) are very common in youth in the US and represent a major clinical challenge. Clinical Practice Guidelines (CPG) have been developed to help guide the health care provider (HCP) in the diagnosis and management of SRC. Seventy-three percent of HCPs report that they deviate from current concussion CPGs in their clinical practices. The Protection of Athletes with Head Injuries Law in Utah requires HCPs caring for youth with concussions receive continuing education (CE) regarding SRC every three years. Currently there are no CE modules on SRC developed for nurse practitioners (NPs) in the state of Utah.

**Project Purpose:** The purpose of this DNP project was to develop and pilot an evidence-based educational module for primary care NPs in Utah on the evaluation and management of SRC in children and adolescents under the age of 18 years old.

**Methods:** The education module integrates the concussion education curriculum developed by Pamela Mapstone DNP, PCNP. The module incorporates current CPGs and an extensive literature search. Following development of the module three clinical experts in SRC independently reviewed the module. Modifications were made accordingly and a pilot study evaluating the quality and usability of the education module was conducted. Sixteen NPs working in Utah were invited to complete the module followed by a short survey related to user satisfaction. The final version of the education module was modified based on the results of the pilot study.
**Results:** An education module on SRC in youth for NPs working in primary care in Utah was successfully developed and piloted for quality and usability. The results of the pilot study support the content addressing the learning objectives; and that the module was easy to use.

**Conclusion:** The education module tailored to the needs of NPs working in primary care in Utah has the potential to improve NPs’ knowledge of SRC in youth. Further study is recommended to evaluate the effects of the education module on clinical practice outcomes.
INTRODUCTION

Background

Sports-related concussions in the pediatric population have been a topic of great media attention over the past several years. There is good reason for this with 30-45 million youth participating in organized sports in the US and an estimated 2 million sports-related concussions occurring each year (Bryan, Rowhani-Rahbar, Comstock, & Rivara, 2016). American football has been the focus of many reports and though important it should not overshadow that soccer, hockey and basketball are also significant contributors to concussion incidence in the US (Pfister, Pfister, Hagel, Ghali, & Ronksley, 2015).

Considerable attention has been given to sports-related concussions in the medical and scientific research communities. As a result, significant developments in our understanding of concussion pathophysiology, diagnosis, and management have emerged and continue to be refined. It has become apparent that concussions, once thought of as a self-limited event, can have the potential for long-term disability or even death (Daneshvar et al., 2011). This potential increases with a second impact in close proximity to the first (Dessy, Rasouli, & Choudhri, 2014). Despite knowledge about concussions, the incidence of sports-related concussions continues to increase (Harmon et al., 2013).

Youth under the age of 18 years are at the highest risk for sports related concussions as reported in incidence statistics (Karlin, 2011). Youth are at higher risk for concussion because of their increased participation in sports compared to adults (Karlin, 2011). In addition, the increased head to body ratio and weaker neck muscles may also play an important role in the increased incidence of sports-related concussion in youth compared to adults (Pfister et al.,
When youth do sustain a concussion, they tend to require a longer recovery time with more conservative management compared to adults (Grady, 2010). Despite the unique needs of this population, there is a paucity of research (Pfister et al., 2015). This knowledge gap poses challenges for providers caring for youth with sports-related concussions.

Because sports-related concussions represent a significant clinical challenge, several clinical guidelines have been developed to help the clinician through the management of sports-related concussions. One of the most accepted and widely used guideline is the Consensus Statement on Concussion in Sports (McCrory, Meeuwisse, Aubry, Cantu, Dvorák et al., 2013). A recent study has shown that following current concussion guidelines leads to quicker return to play and significantly decreased symptoms with return to school. When return to learn and return to play guidelines are followed, concussion symptoms are decreased and recovery is quicker (Brown et al., 2014; Moser, Glatts, & Schatz, 2012). Front line providers consisting of Pediatricians, Emergency Physicians, Family Physicians, and Nurse Practitioners (NPs) must have a complete understanding of current concussion diagnosis and management guidelines. This should include return to play and return to learn guidelines outlined in the consensus statement on concussion in sports to ensure optimal outcomes for their patients with concussions (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013).

Unfortunately, considerable knowledge gaps about concussion guidelines exist in frontline primary care providers including NPs (Zemek et al., 2014a). Only 7.6% of respondents correctly managed grade 1 concussions with 5.6% of the providers reporting current consensus guidelines as a source of their treatment advice in a study of providers managing pediatric patients with concussions (Bazarian, Veenema, Brayer, & Lee, 2001). Likewise, in another study
of primary care providers caring for pediatric patients with concussions, 90% of providers diagnosed concussion correctly, however, only 37% correctly utilized current return to play guidelines as part of their treatment plan (Zemek et al., 2014a). Research supports that a majority of providers do not recommend physical or cognitive rest for sports-related concussions and when they did it was not in accordance with current return to play and return to learn guidelines (Stoller et al., 2014b). These findings are consistent with pediatric providers self-reported knowledge deficit regarding concussions (Zonfrillo et al., 2012).

**Local Problem**

Since 2009, public concern about the proper treatment of concussion has spearheaded initiatives in 49 states and the District of Columbia to enact laws related to reporting and managing of concussions (Straus, 2016). In 2011, Utah legislature passed HB 204 - The Protection of Athletes with Head Injuries law (H.B. 204 Protection of Athletes with Head Injuries, 2011). This law mandates that every amateur sports organization have a concussion protocol in place. It also mandates that every provider caring for individuals with a concussion participate in continuing education every three years regarding concussion evaluation and management (H.B. 204 Protection of Athletes with Head Injuries, 2011).

Utah has the youngest average population age in the nation with just over 30% of its population being under the age of 18 years old. A large number of this population is also active in organized sports. In 2012, the USA activity council data showed that Utah was the most active state in the nation with nearly 62% of the population engaging in high calorie activities (2012 Participation Report: The Physical Activity Council’s annual study tracking sports, fitness and recreation participation in the USA, 2012). This high activity level combined with the large
population of youth under the age of 18 makes make Utah a unique location for pediatric sports related concussions.

It is estimated that there are over 6,200 Utah residents are treated for concussions in the emergency departments each year (Sports concussion, 2015). Of these concussions, 42% are due to sports-related activities (Sports concussion, 2015). Half of all emergency department visits for concussion in Utah were among children under the age of 18 (Sports concussion, 2015).

There are over 1,200 licensed NPs in the state of Utah with the majority working in primary care settings (Utah's Advanced Practice Registered Nurse [APRN] Workforce, 2013). To comply with the concussion continuing education laws and the growing demand for concussion care in the state Utah NPs need access to continuing education on sports-related concussion in the youth. The need for better knowledge transfer efforts regarding sports-related concussions has been identified (Stoller et al., 2014b). Despite this gap in knowledge, there are a limited number of continuing education (CE) modules on sports-related concussions in youth available and suitable for the needs of NPs in the state of Utah. At this time, I am unaware of any continuing education programs regarding sports-related concussions in youth developed for primary care NPs working in Utah.

**Purpose Statement**

The purpose of this DNP project was to develop and pilot an evidence-based educational module on the evaluation and management of sports related concussions in children and adolescents under the age of 18 years old for primary care NPs in Utah. Specifically, the primary objective of this project was to provide an evidence-based, accessible, user-friendly continuing education module to Nurse Practitioners in Utah. Completion of this module will facilitate the
NP’s compliance with the state concussion continuing education policy. The long-term objective of this project is to increase the knowledge of primary care nurse practitioners in Utah (Family Nurse Practitioners and Pediatric Nurse Practitioners) regarding current clinical guidelines for sports concussions in youth.

**Study Question**

Is an evidence-based education module an effective method of educating primary care nurse practitioners in the state of Utah regarding sports related concussion in youth?

**FRAMEWORK AND SYNTHESIS OF EVIDENCE**

**Theoretical Framework**

The tenets of two theories were utilized to support and guide this DNP project. The first of these theories is Rational Decision Making, which falls under the category of cognitive theories. Assumptions of this theory include that in order to provide optimal care, professionals must consider and balance the advantages and disadvantages of different alternative behaviors (Grol et al., 2007). A second assumption is that there must be the provision of convincing information about risk and benefits to promote performance change (Grol et al., 2007). If primary care nurse practitioners in Utah are going to improve care for youth with sports-related concussions supportive evidence and tailored education must be provided to facilitate behavior change.

To help guide the process of this DNP project, the Logic Model (LM) was utilized. The LM helps to organize and guide the development of a project or program. Likewise, this model encourages iterative development of an idea, program or project (Knowlton & Phillips, 2012). Graphics are used to organize and display the process for stakeholders (Knowlton & Phillips,
There are five main components of the logic model: inputs, activities, outputs, outcomes, and impact (Sundra, 2003).

Inputs are defined as the resources that go into the project (Sundra, 2003). These inputs can include human, financial, community, and technological resources that influence the project or are necessary for the project (Kellogg, 2004). The inputs for this project include evidence on the evaluation and management of sports-related concussion in youth, Utah’s Protection of Athletes with Head Injuries law, nurse practitioners practicing in the primary care setting in Utah and other technical and computer resources needed to develop an educational module.

Program activities are the actions of the program (Kellogg, 2004). These actions explain how the resources are utilized in the program (Kellogg, 2004). The activities for this project will include the synthesis of an educational module on concussion in youth based on current evidence, and a pilot study of this educational module with nurse practitioners practicing in Utah.

Outputs of a logic model are defined as the products produced by the program activities (Kellogg, 2004). The outputs of the above program activities will be an evidence-based educational module on sports-related concussions in youth and data regarding the effectiveness and overall performance of the educational module.

Outcomes are defined in a logic model as the specific changes or objectives that the project trying to accomplish (Kellogg, 2004). For this project, the outcomes are reflected in the objectives. The primary objective is to provide an evidence-based, accessible, user-friendly continuing education module to NPs in Utah, the second objective is to increase the knowledge of primary care NPs in Utah regarding current clinical guidelines for sports concussions in youth.
The impact of a project is defined in a logic model as the fundamental intentional or unintentional changes that will occur in a community or system as a result of program activities (Kellogg, 2004). The desired impact of this project, which will be measured after this DNP student is graduated, is the improvement in the assessment, management, and long-term outcomes for youth with sports-related concussions in Utah. A secondary impact factor is improved access to resources to help nurse practitioners in Utah comply with the Utah State Protection of Athletes with Head Injuries law.

Concepts

The major concepts for this DNP project include concussion, primary care NP, children and adolescents, and evidence-based educational module. Concussion is defined in several different ways in the literature. Because this project will focus on sports-related concussions the American Medical Society of Sports Medicine’s (AMSSM) definition of concussion will be used. AMSSM defines concussion as a traumatically induced transient disturbance of brain function and involves a complex pathophysiological process (Harmon et al., 2013, para. 4). Concussion is a subset of mild traumatic brain injury (MTBI) (Harmon et al., 2013). Sports-related concussion is any concussion sustained as a result of participation in sports.

Primary care NPs are defined as Family Nurse Practitioners (FNP) or Pediatric Nurse Practitioners (PNP) practicing in a primary care setting where they see or potentially could see sports related concussion.

For the purposes of this project, children and adolescents are defined as individuals between the ages of eight and eighteen years old.
An evidenced-based educational module is defined as a self-contained educational course that utilizes current literature as evidence to support the educational program and concepts. This project focused on sports related concussions in youth and utilized current evidence to educate participants on evaluation and management of sports related concussions.

**Synthesis of Evidence**

This appraisal and synthesis of evidence is comprised of two parts. First existing sports-related concussion guidelines will be reviewed as a background on standards for primary care nurse practitioners. Second, existing literature regarding nurse practitioners’ knowledge of concussion guidelines and the identified gaps in their knowledge will be appraised.

**Existing Guidelines on Sports-Related Concussion**

With over 3 million sports-related concussions a year in the United States, sports-related concussions pose a significant challenge to primary care nurse practitioners caring for youth and adolescents. Clinical practice guidelines (CPGs) on concussion provide evidence-based resources to help NPs improve outcomes and provide competent care to youth with sport-related concussions.

Current CPGs are provided by several organizations including the American Academy of Pediatrics, American Neurological Association and the American College of Sports Medicine. All of these guidelines are based primarily on the Consensus Statement on Concussion in Sport from the 4th International Conference on Concussion in Sport held in Zurich Switzerland in November, of 2012 (McCrary, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). This guideline is also known as the Zurich Guideline. This consensus statement or guideline is considered the standard for sports-related concussion evaluation and management.
The Zurich guidelines define concussion as a complex pathophysiologic process affecting the brain, induced by biomechanical forces (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). They further provide recommendation on the assessment and management of sports-related concussions in all populations.

As recognition and diagnosis continue to be a relevant clinical issue, the guidelines describe concussion symptoms. Symptoms are broken down into five categories including physical signs, cognitive impairment, behavior changes and sleep disturbances (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). If an individual has sustained a head injury and exhibits one or more symptoms related to the above categories they should be considered to have a concussion (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). Because the diagnosis of concussion is a challenging clinical problem, the Sideline Concussion Assessment Tool 3 (SCAT3) was developed to go along with the Zurich guidelines to aid in detection and diagnosis of sports related concussions (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). This tool has been validated and proven to be useful in the diagnosis of concussion (Putukian et al., 2015).

The consensus statement recommends that all individuals suspected of sustaining a concussion as the result of participation in sports should be immediately removed from play and evaluated with the SCAT3 (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). If diagnosed with a concussion, that individual should not return to play (RTP) on that day and should be evaluated as soon as possible by a health care provider (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013).
After diagnosis, the cornerstone of concussion management should be physical and cognitive rest until symptoms have resolved (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). As symptoms resolve, a graded return to play schedule should be determined and followed (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013).

**Appraisal and Synthesis of the Literature**

To gain a better understanding of primary care NPs’ knowledge, and utilization of current clinical guidelines for sport-related concussion, and the needs for further education in this area, several literature searches were conducted using PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL) and Embase. The following key words were used: Brain concussion, knowledge, health care provider and sport. Related terms such as education, nurse practitioner, management, and guidelines were also used to identify appropriate literature. Inclusion criteria for articles included: published within the last five years, English language, published in an academic journal or conference proceeding and human species. These searches combined yielded a total of 275 results. Articles were excluded if they did not closely relate to primary care provider’s knowledge of sports-related concussion and educational needs. A total of 16 articles met inclusion criteria and related to the project’s purpose (Table 1).

Of the 16 studies that met the criteria for the literature review, only three included NPs in the sample (Master, Zonfrillo, Arbogast, & Grady, 2012; Zemek et al., 2014b; Zonfrillo et al., 2012). Findings from these studies were consistent in identifying knowledge gaps in primary care providers regarding current sports related concussion guidelines.

One study that surveyed primary care providers and then evaluated charts of pediatric patients diagnosed with concussion found that though 60% of providers reported following
current guidelines for cognitive rest only 9 of 96 charts reviewed had any mention of cognitive rest (Master et al., 2012). Gaps in knowledge about cognitive rest guidelines among providers caring for pediatric patients with concussion as well as gaps in knowledge of return to play guidelines as defined by the Zurich guideline were also identified by Zemek et al. (2014). A synthesis of this research supports that primary care providers, including nurse practitioners, do not have adequate training or infrastructure to systematically diagnose or manage patients with concussions (Zonfrillo et al., 2012). A common theme is the identified need for further education regarding current concussion evaluation and management guidelines in nurse practitioners and other primary care providers. Provider-specific education regarding concussion evaluation and management guidelines would help standardize concussion management (Zonfrillo et al., 2012).

In general, there is a paucity of literature evaluating the knowledge base of nurse practitioners regarding sport-related concussion. Though NPs were included in the samples of the above articles, the studies did not breakdown data by provider so it is difficult to make any inference on concussion knowledge specific to nurse practitioners. One exception to this was data comparing nurse practitioners to physicians regarding concussion evaluation. This study reported that physicians and non-physicians in the study equally recognized concussion accurately 85-90% of the time (Zemek et al., 2014b). All of these studies relied primarily on self-reported data in surveys.

Of the remaining articles included in this appraisal, a majority are cross-sectional studies that utilized surveys as a primary source of data collection. Though the majority of studies did not include NPs in their samples they were included in this appraisal to help give a background to the general knowledge among primary care providers regarding sports-related concussions.
After appraisal of the articles found and included in this synthesis of evidence several themes have emerged regarding primary care provider’s knowledge of concussion guidelines.

First, there are several identified gaps in knowledge among primary care providers regarding current concussion guidelines. The first of the identified gaps is in the use of the SCAT3 for evaluation of concussion. Three studies reported that there is a lack of use of the SCAT3 among primary care providers (Lebrun et al., 2013; Santana, Duffaut, & Scott, 2014; Stoller et al., 2014a). Santana et al. (2014) reported that though a majority of providers knew about the SCAT3 only 17.5% used the SCAT3 for evaluation of concussion. Stoller et al. (2014) reported that 78% of pediatricians had never used the SCAT3 for evaluation of concussion. These findings support that there is disconnect in transfer of knowledge to practice regarding the SCAT3 evaluation tool.

Return to play (RTP) and cognitive rest guidelines were also areas of concern identified by several studies. Primary care provider surveys found that only 49% of family physicians and 36% of pediatricians recommended cognitive rest to their patients (Stoller et al., 2014a). Likewise, in another study only 41% of providers answered questions regarding current RTP guidelines correctly (Maynard et al., 2015).

These gaps in knowledge are represented in the lack of utilization of concussion guidelines in clinical practice. Only 10 of 91 patients with concussions had documented instruction or mention of cognitive rest in their medical records (Arbogast et al., 2013). Another study reported only 9 of 96 patients with concussions had documented instruction on cognitive rest in their medical records (Master et al., 2012). It is also important to note that 73.3% of physicians confirmed that they deviated from concussion guidelines in their clinical practices.
(Cooperrider & Seegmiller, 2012). This evidence suggests that there is a gap in the transfer of knowledge to clinical practice.

In contrast to the above studies, Gordon et al., (2014) reported physicians utilized concussion guidelines at a high rate. This study sample was primarily Canadian physicians. Identified weaknesses in this study included compliance with guidelines as the utilization of at least one element of the Zurich guidelines in management of concussions (Gordon, Do, Thompson, & McFaull, 2014). This study was also at high risk for report bias as results were generated though physician report of guidelines unitization instead of chart reviews.

Another theme that was prevalent in the literature appraisal is the need for more education on concussion evaluation and treatment guidelines. Multiple studies reported that there is a need for more training on concussion guidelines among providers in primary care including nurse practitioners (Desai, Sanders, Garcia, & Bentley, 2015; Santana et al., 2014; Zemek et al., 2014b; Zonfrillo et al., 2012).

Three clinical studies and one systematic literature review regarding education modalities and education preferences among primary care providers related to concussion were included in this synthesis (Chrisman, Schiff, & Rivara, 2011; Jain et al., 2014; Lebrun et al., 2013; C. Provvidenza et al., 2013). Jain et al. (2014) provided an evidence-based online curriculum to pediatricians regarding concussion management. Pediatricians self-reported improved management of concussion after participation in the curriculum (Jain et al., 2014). Another study evaluated the effects of sending the CDC’s Heads up toolkit on concussion to providers (Chrisman et al., 2011). This study found that mailing the CDC’s heads up tool kit did improve guidelines compliance with graded RTP but did not improve other measures (Chrisman et al.,
2011). Lebrun et al. (2013) found that primary care providers preferred continuing education activities both in-person and online as a mode of education regarding concussion. Providensa et al. (2013) reported in their qualitative literature review that education on concussion management should be tailored to the specific target audience and that for primary care provider’s education-outreach including online webinars is effective in changing concussion management.

This appraisal and synthesis of literature supports the paucity of evidence regarding nurse practitioners’ knowledge of sport-related concussions and a need for high quality studies in the future. Despite the paucity of research, several gaps in nurse practitioners’ knowledge of guidelines regarding sport-related concussion management and evaluation are identified. It is also possible that these gaps can be narrowed through evidence-based, easily-accessible education on concussions. Evidence also suggests that an online continuing education module may be the preferred delivery method among primary care provider.
## TABLE 1. Evidence Table.

<table>
<thead>
<tr>
<th>Author/Article</th>
<th>Study Purpose</th>
<th>Designs</th>
<th>Sample (N)</th>
<th>Data Collection (Instruments/tools)</th>
<th>Findings</th>
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<tr>
<td>(Arbogast et al., 2013)</td>
<td>Assess pediatric primary care providers’ understanding of cognitive rest for concussion and (2) describe their concussion management practices.</td>
<td>Cross-sectional Study</td>
<td>General pediatric providers N=89</td>
<td>Survey and EMR chart review of children ages 5-18 treated for concussion</td>
<td>1. 52 of the 84 clinicians who included comments about concussion management mentioned cognitive rest (62%, 95% confidence interval [CI] = 51%-72%). 2. Of the 91 EMRs reviewed for patients’ first visits following the concussion, only 10 (11%, 95% CI = 6%-19%) included written cognitive rest recommendations. 3. Although the majority of pediatric providers identified cognitive rest as important in pediatric concussion management, few provided written recommendations in the EMR. 4.</td>
</tr>
<tr>
<td>(Carl &amp; Kinsella, 2014)</td>
<td>1. Determine Illinois pediatricians’ level of familiarity with state concussion legislation and with published consensus guidelines for sports concussion diagnosis and treatment 2. Also sought to determine pediatricians’ knowledge regarding concussion management and comfort treating sports concussion patients</td>
<td>cross-sectional study</td>
<td>Pediatricians Illinois N=158</td>
<td>Survey</td>
<td>1. Few general pediatricians (26.6%, n = 42) were “very familiar” or “somewhat familiar” with the recently passed Illinois state concussion legislation. 2. Only 14.6% (n = 23) of general pediatrician respondents use concussion consensus guidelines in their practice. 3. Pediatricians were generally very knowledgeable about concussions; 4. Conclusions. General pediatricians are knowledgeable about concussions but most are not well aware of state concussion legislation and concussion consensus guidelines.</td>
</tr>
<tr>
<td>(Chrisman et al., 2011)</td>
<td>Evaluate the effect of receiving CDC concussion toolkit on physician concussion knowledge.</td>
<td>RCT</td>
<td>Primary care Physicians N=414</td>
<td>EG: mailed heads up tool kit. CG: not mailed tool kit. Survey conducted following intervention</td>
<td>1. Mailing of the CDC’s “Heads Up” toolkit appears to affect physician recommendations regarding Return to play after a concussion.</td>
</tr>
<tr>
<td>(Cooperrider &amp; Seegmiller, 2012)</td>
<td>The purpose of this study was to determine the knowledge, use, and perceptions of the current standardized guidelines, known as the Zurich guidelines, by physicians and athletic trainers in Washington and Idaho, to determine what barriers exist to implementing these guidelines in clinic, and inquire about ways in which the current guidelines may be improved</td>
<td>Cross-sectional study</td>
<td>Primary care physicians N=46  Athletic trainers N=61</td>
<td>Surveys</td>
<td>1. Majority felt they knew the guidelines and thought they were good. 2. Most did not always follow the guidelines 3. Lack of knowledge or experience using the guidelines was cited as the greatest barrier to clinical implementation 4. 73.7% of physicians and 73.6% of athletic trainers stated that they deviate from the guidelines.</td>
</tr>
<tr>
<td>Author/Article</td>
<td>Study Purpose</td>
<td>Designs</td>
<td>Sample (N)</td>
<td>Data Collection (Instruments/tools)</td>
<td>Findings</td>
</tr>
<tr>
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<td>-------------------------------------------------------------------------------</td>
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<tr>
<td>(Desai et al., 2015)</td>
<td>1. Determine the self-reported practices, attitudes, and knowledge surrounding concussion diagnosis and management by emergency medicine 2. Assess if there is a difference between specialties in current practice</td>
<td>Cross-sectional study</td>
<td>EM and pediatric providers N=105</td>
<td>Survey</td>
<td>1. Concussion assessment tools, 63% of providers stated they never used one, with 66% citing being unaware of any tools. 2. Conclusions: Although pediatric and EM providers regularly care for concussion patients, a lack of adequate training exists among both groups and is cited as the main barrier to adequately diagnose and manage these patients.</td>
</tr>
<tr>
<td>(Gordon et al., 2014)</td>
<td>To assess the use of concussion/mild traumatic brain injury (mTBI) guidelines, criteria used in the initiation of return-to-play (RTP) and management of RTP for brain injured children and youth by pediatricians.</td>
<td>A cross-sectional survey</td>
<td>Pediatricians N=809</td>
<td>Survey</td>
<td>1. High rate of Canadian physicians use guidelines. Criteria used to evaluate use of guidelines are implementation of one component of guidelines in clinical practice.</td>
</tr>
<tr>
<td>(Jain et al., 2014)</td>
<td>To evaluate the effect of a concussion program on pediatricians' self-reported practices and attitudes on the management of concussions</td>
<td>Pre-post test quasi-experimental</td>
<td>Pediatricians Pre test n=204 Post test n=157</td>
<td>Comprehensive evidence-based education curriculum on the management of concussions was provided in a web-based format and in a series of lectures. A pre test and post test were conducted along with the intervention.</td>
<td>1. Implementation of a concussion education program was associated with improvement in pediatricians' self-reported practice and attitudes on managing children with concussions, including comfort level with managing concussions, use of concussion guidelines, and use of evidence-based management strategies.</td>
</tr>
<tr>
<td>(Kinsella, Carl, &amp; Bigosinski, 2012)</td>
<td>Determine the level of sports concussion knowledge and comfort with concussion management amongst general pediatricians</td>
<td>Cross-sectional study</td>
<td>Pediatricians N=270</td>
<td>Survey</td>
<td>1. Overall, pediatricians are knowledgeable about sports concussion diagnosis and management. 2. Majority of pediatricians are not familiar with the consensus guidelines or recently passed legislation that mandates medical clearance following sports concussion</td>
</tr>
<tr>
<td>(C. M. Lebrun et al., 2013)</td>
<td>Identify sports concussion knowledge base and practice patterns in two family physician populations; explore current/preferred methods of knowledge transfer exchange (KTE)</td>
<td>Cross-sectional study</td>
<td>Primary care providers N=189</td>
<td>Survey</td>
<td>1. Few physicians in the study used SCAT3 or did proper cognitive rest according to guidelines. 2. Preferred KTE was continuing education course and online continuing education.</td>
</tr>
<tr>
<td>Author/Article</td>
<td>Study Purpose</td>
<td>Designs</td>
<td>Sample (N)</td>
<td>Data Collection (Instruments/tools)</td>
<td>Findings</td>
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<td>(Master et al., 2012)</td>
<td>Assess the current level of understanding and implementation of the concept of cognitive rest in the management of pediatric concussion among general pediatricians and advanced providers in a single, large pediatric care network.</td>
<td>Cross sectional design</td>
<td>Pediatricians, Nurse Practitioners and physician assistants N=86</td>
<td>Survey and EMR review</td>
<td>1. Of 96 chart reviews only 9 ordered cognitive rest 2. 60% of participants reported using cognitive rest</td>
</tr>
<tr>
<td>(Maynard et al., 2015)</td>
<td>Determine Primary Care Providers knowledge regarding concussion guidelines Hypothesized that concussion knowledge amongst PCPs is not adequate at this time</td>
<td>Cross-sectional study</td>
<td>Primary Care providers, Florida N=not provided</td>
<td>Survey</td>
<td>1. Only 41% answered questions correctly regarding current return to play guidelines. 2. Majority stated they knew guidelines.</td>
</tr>
<tr>
<td>(C. Provvidenza et al., 2013)</td>
<td>Qualitative literature review on health care provider’s opinions and preferences regarding the effectiveness of different modalities of Knowledge Transfer (KT) regarding concussion</td>
<td>Literature review</td>
<td>67 journal articles, 21 websites, 1 book and 1 report were reviewed</td>
<td>PubMed, Medline and Sport Discus databases</td>
<td>1. The value of KT as part of concussion education is increasingly becoming recognized 2. Target audiences benefit from specific learning strategies Identifying the needs, learning styles and preferred learning strategies of target audiences, coupled with evaluation, should be a piece of the overall concussion education puzzle to have an impact on enhancing knowledge and awareness. 3. Physicians liked interactive education sessions. 4. Education outreach was effective in changing physician concussion management. (this includes webinars)</td>
</tr>
<tr>
<td>(Santana et al., 2014)</td>
<td>To examine the attitudes and practices of pediatricians in regards to pediatric concussions</td>
<td>Cross sectional study</td>
<td>Pediatricians N=478</td>
<td>Online survey</td>
<td>1. 56.2%, knew about the Sports Concussion Assessment Tool (SCAT) but only 17.5% used it in their evaluations. 2. Followed return to play guidelines majority of time 3. Pediatricians need improved education to increase confidence and knowledge regarding the use of different modalities to evaluate and manage concussions</td>
</tr>
<tr>
<td>Author/Article</td>
<td>Study Purpose</td>
<td>Designs</td>
<td>Sample (N)</td>
<td>Data Collection (Instruments/tools)</td>
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<tr>
<td>(Stoller et al., 2014a)</td>
<td>To identify differences and gaps in recommendations to patients for the management of sport-related concussion among FPs, emergency department physicians (EDPs), and pediatricians.</td>
<td>Cross-sectional Study</td>
<td>Family Physicians, Emergency department physicians, Pediatricians N=270</td>
<td>Survey</td>
<td>1. 27% of pediatrician respondents reported no knowledge of any consensus statements on concussion in sport, and 54% of FPs, 86% of EDPs, 2. 78% of pediatricians never used the Sport Concussion Assessment Tool, version 2. 3. Only 49% of FPs, 57% of EDPs, and 36% of pediatricians always advised cognitive rest. 4. This study identified large gaps in the knowledge of concussion guidelines for patients with sport-related concussions.</td>
</tr>
<tr>
<td>(Zemek et al., 2014b)</td>
<td>To assess the knowledge of pediatric concussion diagnosis and management among front-line primary care providers.</td>
<td>Cross sectional Study</td>
<td>Family physicians, Emergency medicine physicians, Pediatricians, Nurse Practitioners and physician assistants N=577</td>
<td>Survey</td>
<td>1. Physicians and non-physicians equally recognized concussion (90% [95% CI 86% to 92%]; 85% [95% CI 77% to 90%], respectively). 2. Considerable gaps in knowledge exist in front-line primary care providers with inadequate application of graduated return to play and return to learn following concussion. 3. Consistent application of best evidence-based management using comprehensive guidelines may help to reduce the impact of concussion and persistent post-concussive problems in children and adolescents.</td>
</tr>
<tr>
<td>(Mark R. Zonfrillo et al., 2012)</td>
<td>To determine the self-reported practices and attitudes surrounding concussion diagnosis and management in a single, large pediatric care network.</td>
<td>Cross-sectional study</td>
<td>Primary care providers caring for pediatric patients Pediatricians and Nurse Practitioners N=145</td>
<td>Survey</td>
<td>1. They do not have adequate training or infrastructure to systematically diagnose and manage patients with concussion. 2. Specific provider education, decision support tools, and patient information could help enhance and standardize concussion management.</td>
</tr>
</tbody>
</table>
METHODS

Design

This project incorporated program development using a logic model as a graphic representation. The logic model format was used to guide the development, organization, and pilot study of the educational module on sport-related concussion in youth for primary care nurse practitioners in Utah (Table 4).

Development of the Evidence-Based Education Module

As previously discussed, there is a considerable knowledge gap among NPs and other health care providers working in the primary care setting regarding sports-related concussions (Zemek et al., 2014b). Because of these identified gaps in knowledge it is important that education tools are developed that meet the specific needs of the population to help improve concussion management (Zonfrillo et al., 2012). A recent study suggests that online continuing education modules are the preferred method of knowledge transfer among primary care providers (Lebrun et al., 2013). It is also known that primary care providers prefer interactive education modules (Provvidenza et al., 2013). Education outreach modules including online webinars are effective in changing primary care providers practice regarding concussion management (Provvidenza et al., 2013).

The overall objectives of developing this module were to provide an interactive online continuing education module on sports-related concussion in youth for NPs in Utah. The curriculum for this education module has been informed by the curriculum recently proposed by Pamela Mapstone DNP, CPNP (Mapstone, 2016). This curriculum was selected as a foundation for this module because it is current and evidence based practice, and was developed by an NP
for NPs. The Zurich consensus statement on concussion in sports has also been used to inform this project; it is the most widely accepted guideline for sport-related concussion (McCrory, Meeuwisse, Aubry, Cantu, Dvořák et al., 2013). These two resources along with the previously described appraisal of literature on sport-related concussions in youth have been used to develop the education module.

Seven learning objectives developed by Mapstone (2016) were used as a foundation for this module:

1. Describe the pathophysiology of a concussion.
2. Explain the short and long term consequences of a concussion.
3. Describe the common signs and symptoms of concussion.
4. Assess for symptoms in the affective, cognitive, somatic and sleep domains.
5. Create a management plan based on assessment findings and most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play (p. 251).

The module is introduced with a case study regarding an adolescent patient with a sports-related concussion. Following this case study, a quiz is conducted as part of the module to help participants assess their knowledge of sports-related concussion pathophysiology and guidelines. After completing the quiz, participants are prompted to progress through the module starting with the section on pathophysiology. The participants then progress through sections of the module on signs and symptoms of concussion, assessment of concussion, and management of concussion. After all sections of the module are complete a post-test is conducted to assess key
learning outcomes and concepts of the module. NP participants will not be allowed to progress to the end of the module until 100% of the post-test questions are answered correctly. Both the pre-test and post-test incorporated in the module may be taken multiple times until the outlined level of competency is reached.

NPs in the state of Utah are under considerable time constraints in the clinical setting. It is important that this education works with these time constraints. This module will be submitted for continuing education approval through the American Association of Nurse Practitioners (AANP). Continuing education credits are typically awarded by the number of hours of the education module. The module has been designed to be completed within one hour with the option to complete the module in multiple sessions based on the needs of the practitioner.

**Module Review**

Following the development of the education module, a review of the module was conducted by: Pamela Mapstone, DNP, CPNP, an expert in sports-related concussion diagnosis and management as well as Blaine Winters DNP, ACNP and Gail Skousen MD, both experts in sport-related concussion. The purposes of this review were two fold; first the module was reviewed for accuracy of the content presented according to learning objectives, and second it was reviewed for content validity of the quiz items as they relate to the module and learning objectives.

Reviewers were sent the education module through email. A word document of the module content was also provided to each reviewer. Reviewers were given two weeks to complete the review. Feedback from reviewers was provided in the form of comments and recommendations on the word document.
Each reviewer provided several recommendations for modifications to the module. Dr. Mapstone recommended that more information regarding chronic traumatic encephalitis (CTE) be included in the module. She also contended that the module relied too heavily on the consensus statement on concussion and that more supporting references should be included in the module.

Dr. Winters recommended several grammatical edits. He also commented that there needed to be more information provided regarding CTE. Lastly, Dr. Skousen, provided several minor grammatical edits to the module. See expert reviews in Appendix A.

Modification of the Education Module

Recommended changes to the module were evaluated with subsequent changes made in the module. Following Drs. Mapstone and Winters’ recommendations, additional content was provided regarding CTE. Editorial changes were made in the module. Dr. Skousen recommended several changes to the module that related to military personnel. Because these suggestions do not apply directly to the target population of this project, these changes were not implemented into the module.

Piloting the Educational Module

Following the expert reviews, the education module was piloted by NPs to evaluate the usability and quality of the program including the functionality, flow, ease of use, applicability to clinical practice, presentation style, and time needed to complete the module.
**Pilot Test Survey Development**

An online survey was developed and distributed to each participant, following the participant’s completion of the education module. The Qualtrics survey program was used to develop and collect data from the survey (Qualtrics, 2016).

The objectives of the survey were to evaluate the educational module for quality including quality of function, accuracy of content and applicability to clinical practice. The survey also sought to evaluate the usability and flow of the educational module. Survey items consisted of Likert scale type questions regarding the quality and usability of the module while open-ended questions targeted information on strengths of the program as well as weaknesses of the program (Appendix B).

**Participants**

NPs practicing in the primary care setting in Utah were invited to participate in the educational module. Recruitment was conducted through Brigham Young University College of Nursing and by word of mouth. Originally Utah Nurse Practitioners Inc. was identified to recruit NPs working in the state. However, upon further contact, they were unable to assist in the recruitment process for this pilot study. Thirty-two NPs working in the state of Utah in primary care were contacted via email and invited to participate in the pilot study of the education module (Appendix C).

Each participant in the pilot study was sent a link via email to the education module. In the conclusion section of the education module, an anonymous link to the Qualtrics survey was provided for each participant. Participants in the pilot study were sent the link to the education module and were given two weeks to complete the module and survey. Sixteen NPs responded to
the initial pilot study invitation and were sent the link to the education module and survey. After a period of two weeks ten NPs had completed the Qualtrics survey.

**Ethical Considerations**

**Respect for Persons**

The proposal for this project was submitted to the College of Nursing at University of Arizona using the determination of Human Research form. Notification was received that the project was not considered human research and did not need to be put through the full IRB approval process. Informed consent for participation in this project was given in writing to each participant in the pilot study of the module (Appendix D). An explanation of the project was also given to each participant via email communication.

**Beneficence**

There were no physical, emotional, or financial risks associated with this project. Persons included in the pilot study participated in an educational module on sports-related concussion in youth.

**Justice**

A time frame of two weeks was given to each participant to complete the education module and respond to the survey. No penalty was given for failure to answer any of the survey questions or failure to complete the education module. Because this project was designed for NPs practicing in primary care in Utah, recruitment for this study focused on NPs in Utah. This project utilized participants’ feedback to help improve the usability of the education module on sports-related concussions. Feedback data was collected via a Qualtrics survey, while maintaining anonymity.
TABLE 2. Logic Model.

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Inputs</th>
<th>Activities</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In order to provide optimal care, professionals must consider and balance</td>
<td>Evidence on sports-related concussion in</td>
<td>Synthesis of an educational module on</td>
<td>Evidence based educational module on</td>
<td>Provide an evidence-based, accessible, user-friendly continuing education module to Nurse Practitioners in Utah</td>
<td>1. Improvement in care and outcomes for youth with sports-related concussions in Utah.</td>
</tr>
<tr>
<td>the advantages and disadvantages of different alternative behaviors (Grol,</td>
<td>youth</td>
<td>concussion in youth</td>
<td>sports-related concussions in youth</td>
<td></td>
<td>2. Improved access to resources to help nurse practitioners in Utah comply with the Utah State Protection of Athletes with Head Injuries law</td>
</tr>
<tr>
<td>Bosch, Hulscher, Eccles, &amp; Wensing, 2007)</td>
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<tr>
<td>2. There must be the provision of convincing information about risk and</td>
<td>Concussion law</td>
<td>Pilot study of the educational module</td>
<td>Data regarding the effectiveness and overall</td>
<td>Increase the knowledge of primary care nurse practitioners in Utah regarding current clinical guidelines for sports concussions in youth</td>
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<td>benefits to promote performance change (Grol et al., 2007).</td>
<td></td>
<td></td>
<td>performance of the educational module</td>
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<td></td>
<td>Technical Resources</td>
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<td></td>
<td>NPs in Utah</td>
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</table>
RESULTS

Data Analysis

Survey responses were analyzed using descriptive statistics for all Likert style questions. Open-ended questions were reviewed and summarized. The findings from the survey were then used to inform improvements to the educational module. Each change made to the module was made with the intent to improve the quality and usability of the module to better meet the needs of nurse practitioners practicing in Utah.

Survey Results

All participants in the survey were asked to rate the education module based on ease of use, organization, reading level and if the module met the stated objectives in a Likert scale format. Please refer to Table 3 for a full breakdown of questions and responses.

TABLE 3. Pilot Survey Data.

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>The education module was easy to use.</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>1 (10.0%)</td>
<td>7 (70.0%)</td>
<td>2 (20.0%)</td>
<td>10</td>
</tr>
<tr>
<td>The module was well organized</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>6 (60.0%)</td>
<td>4 (40.0%)</td>
<td>10</td>
</tr>
<tr>
<td>The content was at the appropriate reading level</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>3 (30.0%)</td>
<td>7 (70.0%)</td>
<td>10</td>
</tr>
<tr>
<td>The content addressed the objectives</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>2 (20.0%)</td>
<td>8 (80.0%)</td>
<td>10</td>
</tr>
</tbody>
</table>

Seventy percent (n=7) of the participants agreed that the education module was easy to use, 20% (n=2) strongly agree, and 10% neither disagree or agree. Data supports that the education module was easy to use for NPs working in Utah.
Sixty percent of participants reported that the module was well organized while 40% (n=4) strongly agreed that the module was well organized. These data support adequate organization of the education module for NPs working in primary care in Utah.

Seventy percent of participants (n=7) in the survey reported that they strongly agree that the module was on the appropriate reading level. From the pilot study we can conclude that the module was on the appropriate reading level for NPs working in Utah.

The final Likert scale question concerned the appropriateness of the content of the module. Eighty percent of participants (n=8) strongly agree that the content addressed the objectives of the module. These data suggest that the content of the module addressed the learning objectives of the module.

The survey also asked participants how long it took them to complete module. This data is important to know for continuing education credentialing. Of the 10 respondents to the survey a majority (n=8) reported that the module took less than 30 minutes to complete. Two respondents reported that it took one hour to complete the module. These data support that the module can be completed in under one hour with a majority completing the module in less than 30 minutes. This makes the module suitable for use as a continuing education module for NPs in Utah.

Two open response questions were also included in the survey. The first of these questions asks about the major strength of the education module. There was one main theme in the responses to this question. Six respondents reported that the content of the module was the major strength. One participant reported, “the content was clear and concise” while another,
reported that the “content was timely.” These themes support the quality of the content of the module.

The second question asked what the major weakness of the education module was. Several people reported that there was a glitch in the module that prematurely advanced the slide before they could read it. There was also a comment about the difficulty in reading the module due to the small font and screen size. From these comments, it can be concluded there are some needed changes to the formatting of the education module including the auto advance functions and the font size of the module.

The pilot study highlights the strengths and weaknesses of the education module. It is clear that the module has adequate organization, readability and quality content. There were some technical changes that needed to be made including correction of the auto advance function of each slide and the need to make the slide-viewing window larger for ease of reading.

**Final Module Modifications**

Considering the strengths and weaknesses of the module based on the results of the pilot study, improvements were made to the education module. To help increase the usability of the education module the font size of the module was increased and the width of the viewing screen was enlarged. Both of these changes resulted in improved the utility of the module. The auto advance glitch that was present in the pilot study was also corrected.

**Final Education Module**

Following multiple expert reviews and a pilot study on the usability and quality of the module, several modifications have been made to the original education module. This process has resulted in a well-functioning education module on concussions in youth. The education
module has been piloted among NPs in the target population. The pilot study was critical in identifying technical and other usability issues with the module. Suggestions for improvements have been carefully considered and incorporated in the module. This process has resulted in the successful development of an education module on sport-related concussions in youth for primary care nurse practitioners in Utah. A link to the final version of the education module can be found in Appendix E.

**DISCUSSION**

NPs working in primary care in Utah are frequently presented with the challenge of managing sport-related concussion in youth. With a young population and high rates of sports participation in the state, Utah has special concussion related needs.

The Rational Decision Making Theory states that in order to provide optimal care professionals must consider and balance the advantages and disadvantages of different alternative behaviors (Grol et al., 2007). Health care providers also must be provided with convincing information about risk and benefits to promote performance change (Grol et al., 2007). Providers working in the state need to have the knowledge and skills necessary to care for youth with concussions.

In 2011, the state legislature passed the Protection of Athletes with Head Injuries Law (H.B. 204 Protection of Athletes with Head Injuries, 2011). This law requires that providers in the state obtain training on sport-related concussions at least every three years (H.B. 204 Protection of Athletes with Head Injuries, 2011). There are continuing education modules available for NPs in the state that meet these requirements but none of them are tailored for NPs in Utah. Education is more effective when it is tailored to the target population (Provvidenza et
The purpose of this DNP project was to develop and pilot an evidence-based educational module on the evaluation and management of sports-related concussions in children and adolescents under the age of 18 years old for primary care NPs in Utah.

This project resulted in an education module on sport-related concussion in youth for NPs working in primary care in Utah. The accuracy of the content of this module has been validated through the use of sound literature search techniques, the inclusion of current CPGs on concussion in sport and the use of multiple expert reviews of the module. This module was also piloted for usability and quality by NPs working in Utah. The pilot process was critical in improving the usability of the module to meet the needs of NPs in the state. The resulting module has high quality content, is useable and is tailored to the needs of NPs working in primary care in Utah. This education module is well suited to meet the requirements for Utah NPs continued education on concussion in sports as outlined by the Protection of Athletes with Head Injuries Law (H.B. 204 Protection of Athletes with Head Injuries, 2011).

**Impact on Clinical Practice**

Following the tenets of the Rational Decision Making Theory this module should influence NPs’ clinical practice through the provision of convincing evidence. There is evidence to suggest that web-based education modules can be effective in improving concussion management (Provvidenza & Johnston, 2009). Primary care providers prefer concussion continuing education modules in an online format (Lebrun et al., 2012). These education modules are more effective in changing practice when they are tailored to a specific audience. This project has resulted in a web-based module that is tailored for NPs working in primary care in Utah. Studies evaluating the effectiveness of web-based education modules in changing
concussion management have shown that this mode of education delivery can result in improved concussion management that follows current concussion management guidelines (Chrisman et al., 2011; Jain et al., 2014). This evidence suggests that the education module developed in this DNP project could be effective in changing the concussion management practices of NPs working in primary care in Utah. Ensuring the quality and usability of the module will also facilitate NP learning regarding sport-related concussion and may lead to improved concussion care in youth.

**Limitations**

This project’s purpose was to develop an education module on sport-related concussion in youth for NPs working in primary care in Utah. There are some limitations to the resulting module. Since the module was tailored to NPs working in in Utah modification would need to be made to the module to make it transferable to other settings or NP populations.

One limitation of the pilot study is the use of convenience sampling. Six of the participants in the pilot study were professional colleagues. This may be a source of potential bias in the results of the pilot study. It was originally planned to use Utah Nurse Practitioner Inc. to assist in recruitment for the pilot study. Their bylaws prohibit the distribution of member contact information for the purpose of research. This limited the ability to recruit NPs to the pilot study.

Another limitation is the unknown effect that this education module will have on each provider’s clinical practice and on patient outcomes. Further study is indicated.
Future Implementation

Feedback from content experts and practicing NPs support that this education module has evidence-based content and is useable for NPs working in primary care in Utah. With continuing education approval through AANP, this module will meet the requirements of the Protection of Athletes with Head Injuries Law in Utah.

Following continuing education approval, this module will be disseminated to NPs working in the state of Utah. The Utah Nurse Practitioner Inc. and the Utah chapter of the National Association of Pediatric Nurse Practitioners have both been contacted regarding the future dissemination of this education module. Both organizations have shown interest in offering the education module to their members on their web pages. Ideally this module will be offered through both organizations.

Following distribution of the module, the effect that the module has on clinical practice can and should be evaluated. For example, a chart review of patients seen for concussion by NPs prior to participation in the education module and then following participation in the education module could be undertaken. Perhaps the initial step would be a survey sent to NPs to self-report practice changes made following the completion of the education module. These evaluations will help inform future iterations of the module as well as other education modules developed for NPs working in the state of Utah. With the rapidly changing landscape of concussion management research, updates to this module will need to be made on an annual basis.

CONCLUSION

The development of an education module on sport-related concussions in youth for NPs working in primary care in Utah will fill a need for high quality useable continuing education on
concussion for NPs. With proper dissemination, this module will help to inform NPs in the state of Utah on concussions in youth and help them meet state law requirements for continuing education on sport-related concussions. There is a need to further study this education module to evaluate the effect that this module can have on NPs clinical practice. There is also a need to study the utility of online continuing education specifically designed for NPs. This knowledge will help to inform future iterations of not only this education module but also other education modules that are developed specifically for NPs in the future.
APPENDIX A:

EXPERT REVIEWER FEEDBACK
Expert Reviewer Feedback on Education Module

Pamela Mapstone DNP, PCNP

Hi Craig
I am attaching your module with comments. I don't want to send pre and post test quite yet as there may be changes in those depending on changes in the module. Overall, I think it is a great start. I am concerned that maybe too much info has been eliminated for the sake of time, etc. You will see that with my comments. Think about how we as NP's teach and have to reassure parents and I am not sure that with just the current module, you have provided enough info to educate NP's to do this. For example, CTE is a HUGE concern that parents have. What info do you think would be helpful to tell parents to alleviate anxiety about this? Same with death if they get hit again before they recover! Also, you cite McCrory, et al 2013 too much. There are many articles that support what you are recommending/saying and it makes your project weaker when it seems like you only have 3 or 4 sources of info. I would recommend doing a lit search again and finding the most up to date article and a variety of them to support your module.

Hope that doesn't overwhelm you! Happy to keep working with you on this!
Dr Mapstone
Sport-Related Concussion in Youth for Utah Nurse Practitioners Working in Primary Care

Sport Related Concussion Overview

Approximately 2 million concussions are diagnosed in pediatric patients each year in the US. The majority of these concussions is a direct result of participation in sports (Bryan, Rowhani-Rahbar, Comstock, & Rivera, 2016). An estimated 45,000 U.S. youth actively participate in sports annually. Because of these statistics, sport-related concussions (SRC) are a major concern to the general public as well as the medical community (Bryan et al., 2016). Health care providers, including Nurse Practitioners (NP), receive little training on the evaluation and management of SRC (Mapstone, 2016). As a result, a significant number of SRC remain undiagnosed, and those that are diagnosed frequently are not managed according to current evidence based practice guidelines. Uninformed assessment and management of SRC potentiates the risk of prolonged, or long term, consequences for the youth.

Course objectives

This module provides an update on SRC in youth for NPs working in Utah. The course adapts the SRC concussion in youth course curriculum for Advanced Practice Nurses (APN) developed by Pamela Mapstone, DNP, CPNP (Mapstone, 2016).

Following completion of this course, the NP will be able to:
1. Describe the pathophysiology of SRC in youth.
2. Explain the potential short and long term consequences of SRC in youth.
3. Describe common signs and symptoms of SRC in youth.
4. Assess for symptoms in the affective, cognitive, somatic, and sleep domains.
5. Create a management plan based on assessment findings and most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play.

Course content is taken from the Consensus Statement on Concussion in Sport, and current clinical studies.

Utah concussion law

This education module was developed in response to HB 204, which was passed into law in 2011. This law entitled “The Protection of Athletes with Head Injury Law” mandates that health care providers receive continuing education training on SRC at least every three years (“H.B. 204 Protection of Athletes with Head Injuries,” 2011).

Getting started

To begin the course (for module), review the case study presented in the next three slides and then take the SRC management self-assessment quiz.
Case Study Interaction

HPI
Nathan is a 12 year old male patient that you are seeing for the first time. He presents to your primary care clinic following a head injury sustained while he was playing soccer. He reports that he went up to head the ball and his head collided with another player's head. He initially felt dizzy and confused but continued playing despite the injury. He played the remainder of the game. Following the game Nathan began to have a headache and some associated nausea and photosensitivity. His mother was concerned about his symptoms and brought him in to see you his primary care provider. The injury happened about 3 hours ago. Nathan continues to have a headache, nausea, photosensitivity and some dizziness. He denies any loss of consciousness at the time of the injury. His mother who witnessed the injury, reports that there was no LOC and that Nathan did not have any deficits in his ability to play following the collision.

Med/Allergies/PMHx/ ROS
Medications: Albuterol HFA PRN exercise last used today prior to playing his soccer game.
Allergies: NKA
Past medical history
Pt has a history of exercise-induced asthma and atopic dermatitis. No previous surgeries broken bones or concussions in the past.
Vital signs: HR: 86, BP: 107/65, RR: 16, SpO2: 97%, Temp: 98.7 Wt: 87 pounds Ht: 5’0

Review of System
Constitutional: Feeling tired, and dizzy.
Skin: Skin is pink warm and dry. It is free from rash, lesion or signs of trauma at this time.
HEENT: He denies ringing in the ears or ear pain. Is having a headache that is over the right temporal region. The pain is described as a throbbing pain. He denies visual changes but does report sensitivity to light. No nasal discharge or discharge form the ears.
Cardio: No chest pain, palpitations, or chest wounds.
Respiratory: No difficulty breathing, or cough. He does have a history of exercise-induced asthma that is controlled well on albuterol HFA.
Neuro: Reports dizziness, feeling lightheaded. Denies LOC, no hx of seizures.

Physical Exam:
General: Pt appears anxious and agitated at this time. When light is turned on in exam room pt reports discomfort in eyes with the light on.
HEENT: Head is normocephalic with no evidence of trauma at this time. No tenderness with palpation of the scalp at this time. Ears, hearing is grossly normal to whispered voice, otoscopic exam reveals a normal tm without discharge. Eyes, PERRLA, ICM are intact. Photophobia with exam. Nose, no nasal discharge at this time. Turbinates are pink and moist. Oropharynx, mucus is pink and moist.
Neck: no deformity noted at this time. No pain with active or passive rom. No tenderness with palpation of posterior neck.

Pulmonary: Non labored breathing, vesicular sounds auscultated in all lung fields.
Cardiac: S1, S2 without murmur auscultated.
Neuro: Pt is oriented × 3; CN 2-12 are grossly intact, deep tendon reflexes in patellar tendon are 3+ and equal bilaterally; pt has good muscle strength and coordination in all extremities. Gait is smooth, steady, with good coordination, Romberg is negative.

Introduction to sport-related concussion

This section of the module is designed to help you meet the following learning objectives:

1. Describe the pathophysiology of concussion.
2. Explain the potential short- and long-term consequences of concussion.

Learning activities and content will be directly related to the above objectives. The RTR will be required to read through the content and take the section quiz before progressing to the next section.

Definition of concussion

The following definition for SRC comes from the Consensus Statement on Concussion in Sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012 (McCrory et al., 2013).

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

1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, symptoms and signs may evolve over a number of minutes to hours.
3. Concussion may result in neuropsychological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged (p.1).

Pathophysiology of concussion
The biomechanical forces that cause a concussion are believed to cause temporary neuronal dysfunction ("Heads up to health care providers," 2015). This dysfunction can occur in multiple ways including ionic shifts, altered metabolism, and changes in neuro transmission (Mapstone, 2016). This disruption in neuronal dysfunction is often referred to as a neurometabolic cascade (Mapstone, 2016). This cascade then leads to the variety of symptoms that can be associated with concussion.

Special considerations for youth with concussion
There are important factors to consider when caring for youth with SRC compared to adults with SRC. Youth are at an increased risk for concussion due to their increased participation in sports compared to adults (Karlin, 2011). Youth also may report symptoms of concussion differently than adults (McCrorry et al., 2015). Youth frequently take longer to recover from concussion than adults do (McCrorry et al., 2015). Larger head to body weight ratio and weaker neck muscles compared to adults put youth at a greater risk for SRC (Karlin, 2011). Improper use of protective equipment, lack of sound fundamental skills in sports and limited medical supervision at sporting events also play a role in the increased risk for SRC in the younger population ("Heads up to health care providers," 2015).

Short-term and long term consequences of concussion
80-90% of SRC resolve in the first ten days following injury (McCrorry et al., 2013). This being said, recent developments in our knowledge of concussion have shed light on the long lasting effects that concussions can have on individuals. Chronic Traumatic Encephalopathy (CTE) is one of these potential long term consequences (McCrorry et al., 2013). Research, though in its infancy, reveals that the higher the number of concussion sustained, the greater the risk is for developing CTE (McCrorry et al., 2013; Saigal & Berger, 2014). It is also well documented that when athletes sustain a second concussion inducing head injury while recovering from a concussion there is the potential for sudden death (Saigal & Berger, 2014).

Utah Concussion Considerations
Utah has the youngest average population age in the nation with just over 30% of its population being under the age of 18 years old. A large number of this population is also active in organized sports. In 2012, the USA Activity Council data showed that Utah was the most active state in the nation with nearly 62% of the population engaging in high calorie activities ("2012 Participation Report: The Physical Activity Council’s annual study tracking sports, fitness and recreation participation in the USA," 2012). This high activity level combined with the large population of youth under the age of 18 makes make Utah a unique location for pediatric sports related concussions.

It is estimated that over 6,200 Utah residents are treated for concussions in the emergency departments each year ("Sports concussion," 2015). Of these concussions, 42% are due to sports-related activities ("Sports concussion," 2015). Half of all emergency department visits for concussion in Utah were among children under the age of 18 ("Sports concussion," 2015).
There are over 1,200 licensed NPs in the state of Utah with the majority working in primary care settings ("Utah's Advanced Practice Registered Nurse (APRN) Workforce," 2013).

NPs in the state of Utah need to understand proper SRC management in youth to help prevent prolonged or long-term consequences of SRC.

**Introduction to History**

As with all clinical situations, an in-depth history and physical exam are important in SRC. This section of the module will focus on mastery of the following learning objectives:

3. Describe the common signs and symptoms of concussion.
4. Assess for symptoms in the affective, cognitive, somatic, and sleep domains.

**History**

A thorough history is an important part of the evaluation of SRC. Every history should start with an HPI that includes mechanism of injury, and current symptoms. Included in health history systematic questioning of current symptoms should be included.

Consciousness symptoms vary from person to person. Symptomology often depends on the area of the brain that is injured and is therefore symptoms are unpredictable form concussion to concussion. There are four main categories of symptoms that should be focused on in the health history ("Heads up to health care providers," 2015).

- **Somatic**
- **Cognitive**
  - Confusion, anterograde amnesia, retrograde amnesia, loss of consciousness, disorientation, feeling mentally “foggy”, vacant stare, inability to focus, delayed verbal and motor responses, slurred/incoherent speech, excessive drowsiness.
- **Affective**
  - Emotional lability, irritability, fatigue, anxiety, sadness.
- **Sleep**
  - Trouble falling asleep, sleeping more than usual, sleeping less than usual.

("Heads up to health care providers," 2015)

**Physical Exam**

The physical exam in SRC should focus on neurologic testing with a complete neurologic exam including mental status, cranial nerves, coordination: deep tendon reflexes, motor and sensory
testing and balance testing exams (McCrorry et al., 2013). A neck exam for possible C-spine injury should also be included in the physical exam (McCrorry et al., 2013).

**SCAT3**

There have been several SRC assessment tools developed to help with the evaluation of SRC. Of the assessment tools currently in use the Sideline Concussion Assessment Tool 3 (SCAT3) is the most widely utilized and available assessment tool for SRC (McCrorry et al., 2013). This tool includes the SCAT3 for individuals 13 years of age or older and the Child-SCAT3 for children younger than 13 years of age (McCrorry et al., 2013). This tool is designed to guide the clinician through the history and physical for the patient with a suspected SRC and includes assessment of Glasgow coma scale, Maddocks score, symptoms checklist, cognitive assessment, neck examination, balance testing and coordination examination. Each section listed above is scored according to the rubric and a total score is tabulated giving a final score out of 100. The lower the score compared to baseline testing the higher the suspicion of concussion.

This test has proven to be very effective in the detection of concussion when used at baseline and post injury. It is estimated by one study that when SCAT3 scores are 3.5 points lower post injury compared to baseline results there is a 96% sensitivity and 83% specificity for SRC (Putukian et al., 2015). There is still limited data on the use of the SCAT3 as a stand-alone test without baseline testing. Evidence does suggest that the SCAT3 should be used as a baseline assessment prior to participation in sports (Chin, Nelson, Barr, McCrorry, & McCrea, 2016; Jingui et al., 2012; Putukian et al., 2015; Valovich McLeod, Bay, Lerm, & Chhabra, 2012).

Forms for the SCAT3 and Child SCAT3 can be found here: [Link to SCAT3 and Child SCAT3 forms](#)

**Diagnostic testing**

**Laboratory studies:** To date there is very little evidence to suggest that laboratory studies are beneficial in the evaluation and management of SRC (McCrorry et al., 2013).

**Neuro imaging:** Evidence suggests that neuroimaging is not beneficial in the initial evaluation of SRC (McCrorry et al., 2013). Neuroimaging should be considered in those individuals with LOC, suspected skull fracture, worsening symptoms or focal neurologic deficits (McCrorry et al., 2013).

**Diagnosis of concussion**

The diagnosis of concussion is made clinically. If any of the following components are present in association with a head injury a concussion should be suspected, and the appropriate management should be initiated (McCrorry et al., 2013).

1. Symptoms (as discussed previously including somatic, cognitive, and affective symptoms).
2. Physical signs (LOC, amnesia).
3. Behavioral changes.
5. Sleep disturbances.
(McCrory et al., 2013)

Introduction to Management
This section of the module will focus on the following learning objectives:
5. Create a management plan based on assessment findings and most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play.

Principles of Concussion Management
There are four main components of SRC management
1. Removal from play.
2. Rest both physical and cognitive.
3. Graded return to play (RTP).
4. Graded return to learn (RTL).

Each of these components will be discussed in further detail.

Removal from play
The first step in SRC management is removal of the athlete from play. This is done for two reasons: first to prevent further injury, second to allow for proper evaluation by medical professionals. Once a player is removed from play for a suspected concussion that player should not return to play on the day of injury and until cleared by a qualified medical professional (McCrory et al., 2013).

Physical and cognitive rest or restructuring
What is physical rest?
Physical rest is the avoidance of physical activity that may induce concussion symptoms.

What is cognitive rest?
Cognitive rest consists of avoidance of any cognitive activity that may induce or exacerbate concussion symptoms (McCrory et al., 2013). Cognitive rest can also be referred to as cognitive restructuring (National Guideline). This restructuring of cognitive activities will be different for each patient. For some cognitive activities that exacerbate symptoms may include use of electronic devices and for other school may exacerbate symptoms (National Guideline). Cognitive and physical rest should be prescribed on an individual basis tailored to the symptoms of each individual patient (Giza et al., 2013).

Physical and cognitive rest is the foundation of concussion management (McCrory et al., 2013). The optimal timeframe of an initial rest period is still under debate. One study recently found that a duration of 24-48 hours of physical and cognitive rest resulted in a quicker recovery form
symptoms than did a period of 5 days of physical and cognitive rest (Thomas, Apps, Hoffmann, McCrea, & Hammeke, 2015). An initial prescription of 24-48 hours of physical and cognitive rest is an appropriate starting point in the management of SRC (McCrory et al., 2013). Physical and cognitive rest should then be continued in some form until symptoms have resolved (McCrory et al., 2013). When caring for youth with SRC it is important to remember that recovery may be slower and a more conservative approach may be needed (McCrory et al., 2013).

Return to Learn

Return to learn (RTL) should be initiated once concussion symptoms have subsided (McCrory et al., 2013; National Guideline). At this point, cognitive tasks previously avoided due to the exacerbation of symptoms should be added back in to activities of daily living gradually until the patient is able to participate fully in school and other cognitive activities without exacerbation of symptoms. If symptoms are exacerbated, backing off of cognitive activities for 24 hours is an appropriate approach (McCrory et al., 2013). This gradual return to school and other social and cognitive activities should precede return to sports or activity (McCrory et al., 2013).

Return To Play

Return to play (RTP) should be approached in a gradual manner once concussion symptoms have resolved and the patient has been able to return to school and social activities (McCrory et al., 2013). The following graded return to play schedule has been proposed by in the consensus statement on concussion in sport (McCrory et al., 2013).

| Graded Return to Play Protocol (McCrory et al., 2013) |
|---------------------------------|---------------------------------|---------------------------------|
| Rehabilitation Stage | Functional exercise at each stage of rehabilitation | Objective of each stage |
| 1. No activity | Complete physical and cognitive rest | Recovery |
| 2. Light aerobic exercise | Walking, swimming, stationary bike with HR <70% max | Increase heart rate |
| 3. Sport specific exercise | Running drills without contact | Add movement |
| 4. Non-contact training | More complex drills without contact | Exercise, coordination and cognitive load |
| 5. Full contact | Normal training | Restore confidence |
| 6. Return to play | Normal game play | |

Each step in the return to play protocol represents a 24-hour period. If symptoms are exacerbated physical activity should be reduced to the previous step for a 24 hour period (McCrory et al., 2013).

When to refer to specialist
Most SRC can and will be managed successfully in the primary care setting (McCory et al., 2013). When cases of SRC exceed the 10-day expected recovery time with proper management the patient should be referred to a health care provider with experience and expertise in SRC management (McCory et al., 2013). Examples of appropriate referrals would be a concussion specialist or a neurologist.

Conclusion
SRC are a major health care concern for NPs practicing in Utah. With proper care, a majority of patients with concussion will return to full activity without prolonged or long-term impairments. It is important that the NP understands the common signs and symptoms associated with SRC and understands how to properly perform the needed components of the physical exam for SRC. Once the diagnosis of SRC is made following current concussion guidelines in the management of SRC including removal from play RITL and RTP guidelines has been proven to improve recovery time in SRC.
References


Blaine Winters DNP, ACNP
Hi Craig,
I have reviewed your project and made a few grammatical changes using track changes as well as provided some comments.

Blaine
Sport-Related Concussion in Youth for Utah Nurse Practitioners Working in Primary Care

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Course objectives

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To begin the course (for module), review the case study presented in the next three slides and then take the SRC management self-assessment quiz.
Case Study Interaction

HPI
Nathan is a 12 year old male patient that you are seeing for the first time. He presents to your primary care clinic following a head injury sustained while he was playing soccer. He reports that he went up to head the ball and his head collided with another player's head. He initially felt dizzy and confused but continued playing despite the injury. He played the remainder of the game. Following the game Nathan developed a headache and some associated nausea and photosensitivity. His mother was concerned about his symptoms and brought him in to see you his primary care provider. The injury happened about 8 hours ago. Nathan continues to have a headache, nausea, photophobia and some dizziness. He denies any loss of consciousness at the time of the injury. His mother who witnessed the injury, reports that there was no LOC and that Nathan did not have any deficits in his ability to play following the collision.

Medications: Albuterol HFA PRN exercise was used today prior to playing his soccer game.
Allergies: NKA
Past medical history
Pt has a history of exercise-induced asthma and atopic dermatitis. No previous surgeries broken bones or concussions in the past.

Review of Systems
Constitutional: Feeling tired, and dizzy.
Skin: Skin is pink, warm, and dry. It is free from rash, lesion or signs of trauma at this time.
HEENT: He denies ringing in the ears or ear pain. Is having a headache that is over the right temporal region. The pain is described as a throbbing pain. He denied visual changes but does report sensitivity to light. No nasal discharge or discharge from the ears.
Cardiac: No chest pain, palpitations, or chest wounds.
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General: Pt appears anxious and agitated at this time. When light is turned on in exam room patient reports discomfort in the eyes with the light on.
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Pathophysiology of concussion
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**Diagnosis of concussion**

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1. Symptoms (as discussed previously including somatic, cognitive, and affective symptoms).
2. Physical signs (LOC, amnesia).
3. Behavioral changes.
5. Sleep disturbances.

(McCrory et al., 2013)

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This section of the module will focus on the following learning objectives:

5. Create a management plan based on assessment findings and the most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play.

Principals of Concussion management

There are four main components of SRC management

1. Removal from play.
2. Rest both physical and cognitive.
3. Graded return to play (RTPI).
4. Graded return to learn (RTL).

Each of these components will be discussed in further detail.

Removal from play:
The first step in SRC management is removal of the athlete from play. This is done for two reasons: first to prevent further injury, second to allow for proper evaluation by medical professionals. Once a player is removed from play for a suspected concussion that player should not return to play on the day of injury and until cleared by a qualified medical professional (McCrory et al., 2013).

Physical and cognitive rest or restructuring

What is physical rest?
Physical rest is the avoidance of physical activity that may induce concussion symptoms.

What is cognitive rest?
Cognitive rest consists of avoidance of any cognitive activity that may induce or exacerbate concussion symptoms (McCrory et al., 2013). Cognitive rest can also be referred to as cognitive restructuring (National Guideline). This restructuring of cognitive activities will be different for each patient. For some cognitive activities that exacerbate symptoms, may include the use of electronic devices and for others, school may exacerbate symptoms (National Guideline). Cognitive and physical rest should be prescribed on an individual basis tailored to the symptoms of each individual patient (Giza et al., 2013).

Physical and cognitive rest is the foundation of concussion management (McCrory et al., 2013). The optimal timeframe of an initial rest period is still under debate. One study recently found that a duration of 24-48 hours of physical and cognitive rest resulted in a quicker recovery form
There are over 1,200 licensed NPs in the state of Utah with the majority working in primary care settings ("Utah’s Advanced Practice Registered Nurse [APRN] Workforce," 2015).

NPs in the state of Utah need to understand proper SRC management in youth to help prevent prolonged or long-term consequences of SRC.

**Introduction to History Taking, Physical Exam, and Diagnostic Testing in SRC**

As with all clinical situations, an in-depth history and physical are important in SRC. This section of the module will focus on mastery of the following learning objectives:

3. Describe the common signs and symptoms of concussion.

4. Assess for symptoms in the affective, cognitive, somatic, and sleep domains.

**History**

A thorough history is an important part of the evaluation of SRC. Every history should start with an HPI that includes mechanism of injury, and current symptoms. Included in health history systematic questioning of current symptoms should be included.

Concussion symptoms vary from person to person. Symptomology often depends on the area of the brain that is injured and is therefore symptoms are unpredictable form concussion to concussion. There are four main categories of symptoms that should be focused on in the health history ("Heads up to health care providers," 2015).

**Somatic**

- Headache, Dizziness, Balance disruption, Nausea/Vomiting, Visual disturbances (photophobia, blurry/double vision), phonophobia.

**Cognitive**

- Confusion, anterograde amnesia, retrograde amnesia, loss of consciousness, disorientation, feeling mentally "foggy", vacant stare, inability to focus, delayed verbal and motor responses, slurred/incoherent speech, excessive drowsiness.

**Affective**

- Emotional lability, irritability, fatigue, anxiety, sadness.

**Sleep**

- Trouble falling asleep, sleeping more than usual, sleeping less than usual.

("Heads up to health care providers," 2015)

**Physical Exam**

The physical exam in SRC should focus on neurologic testing with a complete neurologic exam including mental status, cranial nerves, coordination deep tendon reflexes, motor and sensory
symptoms than did a period of 5 days of physical and cognitive rest (Thomas, Apps, Hoffmann, McCrea, & Hammelke, 2015). An initial prescription of 24-48 hours of physical and cognitive rest is an appropriate starting point in the management of SRC (McCrory et al., 2013). Physical and cognitive rest should then be continued in some form until symptoms have resolved (McCrory et al., 2013). When caring for youth with SRC it is important to remember that recovery may be slower and a more conservative approach may be needed (McCrory et al., 2013).

Return to Learn
Return to learn (RTL) should be initiated once concussion symptoms have subsided (McCrory et al., 2013; National Guideline). At this point, cognitive tasks previously avoided due to the exacerbation of symptoms should be added back in to activities of daily living gradually until the patient is able to participate fully in school and other cognitive activities without exacerbation of symptoms. If symptoms are exacerbated, backing off of cognitive activities for 24 hours is an appropriate approach (McCrory et al., 2013). This gradual return to school and other social and cognitive activities should precede return to sports or activity (McCrory et al., 2013).

Return To Play
Return to play (RTP) should be approached in a gradual manner once concussion symptoms have resolved and the patient has been able to return to school and social activities (McCrory et al., 2013).

The following graded return to play schedule has been proposed by the consensus statement on concussion in sport (McCrory et al., 2013).

| Graded Return to Play Protocol [McCruy et al., 2013] |
|---------------------------------|-------------------------------------------------|--------------|
| Rehabilitation Stage | Functional exercise at each stage of rehabilitation | Objective of each stage |
| 1. No activity | Complete physical and cognitive rest | Recovery |
| 2. Light aerobic exercise | Walking, swimming, stationary bike with HR <70% max | Increase heart rate |
| 3. Sport specific exercise | Running drills without contact | Add movement |
| 4. Non-contact training | More complex drills without contact | Exercise, coordination and cognitive load |
| 5. Full contact | Normal training | Restore confidence |
| 6. Return to play | Normal game play | |

Each step in the return to play protocol represents a 24-hour period. If symptoms are exacerbated physical activity should be reduced to the previous step for a 24 hour period (McCruy et al., 2013).

When to refer to specialist
References


Gail Skousen MD, Family Medicine
Sorry it took longer than you hoped, I have made comments with the editing function on so that you can choose to accept or delete.

Overall looks good, thanks
Sport-Related Concussion in Youth for Utah Nurse Practitioners Working in Primary Care

Sport Related Concussion Overview
There are nearly 2 million concussions diagnosed in pediatric patients in the US each year, with a majority of those concussions a direct result of participation in sports (Bryan, Rowhani-Rahbar, Comstock, & Rivera, 2016). It is estimated that 45,000 youth actively participate in sports in the US each year. Because of this, sport-related concussions (SRC) are a major concern to the general public as well as to the medical community (Bryan et al., 2016). Health care providers, including Nurse Practitioners (NP) receive little training on the evaluation and management of SRC (Mapstone, 2016). As a result of this, a large number of SRC are never diagnosed and those that are diagnosed are frequently managed outside of current evidence based practice guidelines. This potentiates the risk of prolonged, or long term, consequences of SRC.

Course objectives
This course seeks to update NPs working in Utah on SRC in youth. The course is based off of the SRC concussion in youth course curriculum for Advanced Practice Nurses developed by Pamela Mapstone, DNP, CPNP (Mapstone, 2016). Course objectives have been adapted from that curriculum. Following completion of this course, the NP will be able to:
1. Describe the pathophysiology of a concussion.
2. Explain the potential short and long term consequences of concussion.
3. Describe common signs and symptoms of concussion.
4. Assess for symptoms in the effective, cognitive, somatic, and sleep domains.
5. Create a management plan based on assessment findings and most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play.

Course content is taken form the consensus statement on concussion in sport, and current clinical studies.

Utah concussion Law
This education model was developed in response to HB 204 that was passed into law in 2011. This law entitled "The Protection of Athletes with Head Injury Law" mandates that health care providers receive continuing education training on SRC at least every three years ("H.B. 204 Protection of Athletes with Head Injuries," 2011).

Getting started
To begin the course, review the case study presented in the next three slides and then take the SRC management self-assessment quiz. Once you have finished the quiz, you will be able to progress through the SRC in your course.

Case Study Interaction

HPI
Nathan is a 12 year old male presenting to your clinic following a head injury sustained while he was playing soccer. He reports that he went up to head the ball and his head collided with another player’s head. He initially felt dizzy and confused but continued playing despite the injury. He played the remainder of the game. Following the game Nathan began to have a headache and some associated nausea and photosensitivity. His mother was concerned about his symptoms and brought him in to see you his primary care provider. The injury happened about 1 hour ago. Nathan continues to have a headache, nausea, photosensitivity and some dizziness. He denies any loss of consciousness at the time of the injury.

Meds/Allergies/PMHx/ ROS
Medications: Albuterol HFA PRN exercise
Allergies: NKA
Past medical History
Pt has a history of exercise-induced asthma, and atopic dermatitis. No previous surgeries, broken bones or concussions in the past.

Review of Systems
Constitutional: Feeling tired, and dizzy.
HEENT: He denies ringing in the ears or ear pain. Is having a headache that is over the right temporal region. The pain is described as a throbbing pain. He denies visual changes but does report sensitivity to light. No nasal discharge or discharge form the ears.
Cardiac: No chest pain, palpitations, or chest wounds.
Respiratory: No difficulty breathing, or cough. He does have a history of exercise-induced asthma that is controlled well on albuterol HFA.
Neuro: Reports dizziness, feeling lightheaded. Denies LOC, no hx of seizures.

Physical Exam:
General: Pt appears anxious and agitated at this time. He is uncomfortable with the light on.
HEENT: Head is normocephalic with no evidence of trauma at this time. Ears, hearing is grossly normal, otoscopic exam reveals a normal tm without d/c. eyes, PERRLA, EOM are appropriate in all directions, Pt appears in pain due to brightness of the light during exam. Nose, no nasal d/c at this time. Turbinates are pink and moist. Oropharynx, mucosa is pink and moist.
Pulmonary: Non labored breathing. Vesicular sounds auscultated in all lung fields.
Cardiac: S1, S2 auscultated.
2016). This disruption in neuronal dysfunction is often referred to as a neurometabolic cascade (Mapstone, 2016). This cascade then leads to the variety of symptoms that can be associated with concussion.

Special considerations for youth with concussion
There are important factors to consider when caring for youth with SRC compared to adults with SRC. Youth are at an increased risk for concussion due to their increased participation in sports compared to adults (Kavlock, 2011). Youth also may report symptoms of concussion differently than adults (McCrory et al., 2013). Youth frequently take longer to recover from concussion than adults do (McCrory et al., 2013). Youth is larger head to body weight ratio and weaker neck muscles compared to adults also put youth at a greater risk for SRC (Kavlock, 2011).

Short-term and long term consequences of concussion
80-90% of SRC resolve in the first ten days following injury (McCrory et al., 2013). This being said, recent developments in our knowledge of concussion have shed light on the long lasting effects that concussions can have on individuals. Chronic Traumatic Encephalopathy (CTE) is one of these potential long term consequences (McCrery et al., 2013). Research, though in its infancy, reveals that the higher the number of concussion sustained, the greater the risk is for developing CTE (McCrory et al., 2013; Saigal & Berger, 2014). It is also well documented that when athletes sustain a second concussion, inducing head injury, while recovering from a concussion there is the potential for sudden death (Saigal & Berger, 2014).

Utah Concussion Considerations
Utah has the youngest average population age in the nation with just over 30% of its population being under the age of 18 years old. A large number of this population is also active in organized sports. In 2012, the USA activity council data showed that Utah was the most active state in the nation with nearly 62% of the population engaging in high caloric activities ("Participation Report: The Physical Activity Council’s annual study tracking sports, fitness and recreation participation in the USA," 2012). This high activity level combined with the large population of youth under the age of 18 makes Utah a unique location for pediatric sports related concussions.

It is estimated that over 6,200 Utah residents are treated for concussions in the emergency departments each year ("Sports concussion," 2013). Of these concussions, 42% are due to sports related activities ("Sports concussion," 2013). Half of all emergency department visits for concussion in Utah were among children under the age of 18 ("Sports concussion," 2013).

There are over 1,200 licensed NPs in the state of Utah with the majority working in primary care settings ("Utah’s Advanced Practice Registered Nurse (APRN) Workforce," 2013). NPs in the state of Utah need to understand proper SRC management in youth to help prevent prolonged or long term consequences of SRC.
Neuro: Pt is oriented x3 CN 1-12 are intact, deep tendon reflexes in patellar tendon are 3+ and equal bilaterally: pt has good muscle strength and coordination in all extremities. Romberg test is normal at this time.

**Introduction to Sport-Related concussion**

This section in the module is designed to help you meet the following learning objectives:

1. Describe the pathophysiology of concussion.
2. Explain the potential short- and long-term consequences of concussion.

Learning activities and content will be directly related to the above objectives. The provider will be required to read through the content and take the section quiz before you will be allowed to progress to the next section of the module.

**Definition of concussion**

The following definition for SRC comes from the Consensus Statement on Concussion in Sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012 (McCrory et al., 2013).

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

1. Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, symptoms and signs may evolve over a number of minutes to hours.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged. (pg.1)

**Pathophysiology of concussion**

The biomechanical forces that cause a concussion are believed to cause temporary neuronal dysfunction ("Heads up to healthcare providers," 2015). This dysfunction can occur in multiple ways including ionic shifts, altered metabolism, and changes in neurotransmission (Maystone,
Historical and Diagnostic Testing in SRC

As with all clinical situations, an in-depth history and physical are important in SRC. This section of the module will focus on mastery of the following learning objectives:

3. Describe common signs and symptoms of concussion.
4. Assess for symptoms in the affective, cognitive, somatic and sleep domains.

History

A thorough history is an important part of the evaluation of SRC. Every history should start with an HPI that includes mechanism of injury, and current symptoms. Included in health history systematic questioning of current symptoms should be included. Concussion symptoms vary from person to person. Symptomology often depends on the area of the brain that is injured and is therefore symptoms are unpredictable form concussion to concussion. There are four main categories of symptoms that should be focused on in the health history ("Heads up to health care providers," 2015).

Somatic

Cognitive
- Confusion, anterograde amnesia, retrograde amnesia, loss of consciousness, disorientation, feeling mentally "foggy", vacant stare, inability to focus, delayed verbal and motor responses, slurred/incoherent speech, excessive drowsiness.

Affective
- Emotional lability, irritability, fatigue, anxiety, sadness.

Sleep
- Trouble falling asleep, sleeping more than usual, sleeping less than usual.

("Heads up to health care providers," 2015)

Physical Exam

The physical exam in SRC should focus on neurologic testing with a complete neurologic exam including mental status, cranial nerves, coordination deep tendon reflexes, motor and sensory testing and balance testing exams (McCory et al., 2013). A Neck exam for possible C-spine injury should also be included in the physical exam (McCory et al., 2013).

SCAT3

There have been several SRC assessment tools developed to help with the evaluation of SRC. Of the assessment tools currently in use the Sideline Concussion Assessment Tool 3 (SCAT3) is the most widely utilized and available assessment tool for SRC (McCory et al., 2013). This Tool
includes the SCAT3 for individuals 13 years of age or older and the Child-SCAT3 for children younger than 13 years of age (McCrory et al., 2013). This tool is designed to guide the clinician through the history and physical for the patient with a suspected SRC and includes assessment of Glasgow coma scale, Maddocks score, symptoms checklist, cognitive assessment, neck examination, balance testing and coordination examination. Each section listed above is scored according to the rubric and a total score is tabulated giving a final score out of 100. The lower the score compared to baseline testing the higher the suspicion of concussion.

This test has proven to be very effective in the detection of concussion when used at baseline and post injury. It is estimated by one study that when SCAT3 scores are 3.5 points lower post injury compared to baseline results there is a 96% sensitivity and 81% specificity for SRC (Putulian et al., 2015). There is still limited data on the use of the SCAT3 as a stand-alone test without baseline testing. Evidence does suggest that the SCAT3 should be used as a baseline assessment prior to participation in sports (Chin, Nelson, Barr, McCrory, & McCrea, 2015; Jingui et al., 2012; Putulian et al., 2015; Valovich McLeod, Bay, Lam, & Chhabra, 2012).

Forms for the SCAT3 and Child SCAT3 can be found here: [Link to SCAT3 and Child SCAT3 forms]

Diagnostic testing

Laboratory studies: To date there is very little evidence to suggest that laboratory studies are beneficial in the evaluation and management of SRC (McCrory et al., 2013).

Neuro Imaging: Evidence suggests that neuroimaging is not beneficial in the initial evaluation of SRC (McCrory et al., 2013). Neuroimaging should be considered in those individuals with LOC, suspected skull fracture, worsening symptoms or focal neurologic deficits (McCrory et al., 2013).

Diagnosis of concussion

The diagnosis of concussion is made clinically. If any of the following components are present in association with a head injury a concussion should be suspected, and the appropriate management should be initiated (McCrory et al., 2013).

1. Symptoms (as discussed previously including somatic, cognitive, and affective symptoms).
2. Physical signs (LOC, amnesia).
3. Behavioral changes.
5. Sleep disturbances.
(McCrory et al., 2013)
Intro to Management

This section of the module will focus on the following learning objectives:
5. Create a management plan based on assessment findings and most current recommendations.
6. Identify patients at risk for protracted recovery and evaluate the need for referral.
7. Apply best practices for return to learn and return to play.

Principles of Concussion management

There are four main components of SRC management
1. Removal from play.
2. Rest both physical and cognitive.
3. Graded return to play (RTF).
4. Graded return to learn (RTL).

Each of these components will be discussed in further detail.

Removal from play

The first step in SRC management is removal of the athlete from play. This is done for two reasons; first to prevent further injury, second to allow for proper evaluation by medical professionals. Once a player is removed from play for a suspected concussion that player should not return to play on the day of injury and until cleared by a qualified medical professional (McCrory et al., 2013).

Physical and cognitive rest or restructuring

**What is physical rest?**
Physical rest is the avoidance of physical activity that may induce concussion symptoms.

**What is cognitive rest?**
Cognitive rest consists of avoidance of any cognitive activity that may induce or exacerbate concussion symptoms (McCrory et al., 2013). Cognitive rest can also be referred to as cognitive restructuring (National Guideline). This restructuring of cognitive activities will be different for each patient. For some cognitive activities that exacerbate symptoms may include use of electronic devices and for other school may exacerbate symptoms (National Guideline).

Cognitive and physical rest should be prescribed on an individual basis tailored to the symptoms of each individual patient (National Guideline).

Physical and cognitive rest is the foundation of concussion management (McCrory et al., 2013). The optimal timeframe of an initial rest period is still under debate. One study recently found that a duration of 24-48 hours of physical and cognitive rest resulted in a quicker recover form symptoms than did a period of 5 days of physical and cognitive rest (Thomas, Apps, Hoffmann, McCrea, & Hammers, 2015). An initial prescription of 24-48 hours of physical and cognitive rest is an appropriate starting point in the management of SRC (McCrory et al., 2013). Physical and cognitive rest should then be continued in some form until symptoms have resolved (McCrory et al., 2013). When caring for youth with SRC it is important to remember that recovery may be slower and a more conservative approach may be needed (McCrory et al., 2013).
Return to Learn

Return to learn (RTL) should be initiated once concussion symptoms have subsided (McCrory et al., 2013; National Guideline). At this point, cognitive tasks previously avoided due to the exacerbation of symptoms should be added back into activities of daily living gradually until the patient is able to participate fully in school and other cognitive activities without exacerbation of symptoms. If symptoms are exacerbated, backing off of cognitive activities for 24 hours is an appropriate approach (McCrory et al., 2013). This gradual return to school and other social and cognitive activities should precede return to sports or activity (McCrory et al., 2013).

Return To Play

Return to play (RTP) should be approached in a gradual manner once concussion symptoms have resolved and the patient has been able to return to school and social activities (McCrory et al., 2013). The following graded return to play schedule has been proposed by in the consensus statement on concussion in sport (McCrory et al., 2013).

<table>
<thead>
<tr>
<th>Graded Return to Play Protocol (McCrory et al., 2013)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation Stage</td>
<td>Functional exercise at each stage of rehabilitation</td>
</tr>
<tr>
<td>1. No activity</td>
<td>Complete physical and cognitive rest</td>
</tr>
<tr>
<td>2. Light aerobic exercise</td>
<td>Walking, swimming, stationary bike with HR &lt;70% max</td>
</tr>
<tr>
<td>3. Sport specific exercise</td>
<td>Running drills without contact</td>
</tr>
<tr>
<td>4. Non-contact training</td>
<td>More complex drills without contact</td>
</tr>
<tr>
<td>5. Full contact</td>
<td>Normal training</td>
</tr>
<tr>
<td>6. Return to play</td>
<td>Normal game play</td>
</tr>
</tbody>
</table>

Each step in the return to play protocol represents a 24-hour period. If symptoms are exacerbated during physical activity, the physical activity should be reduced to the previous step for a 24-hour period (McCrory et al., 2013).

When to refer to specialist

Most SRC cases will be managed successfully in the primary care setting (McCrory et al., 2013). When cases of SRC exceed the 10-day expected recovery time with proper management, the patient should be referred to a health care provider with experience and expertise in SRC management (McCrory et al., 2013). Examples of appropriate referrals would be a concussion specialist or a neurologist.
Conclusion

SRC are a major health care concern for NPs practicing in Utah. With proper care, a majority of patients with concussion will return to full activity without prolonged or long-term impairments. It is important that the NP understands the common signs and symptoms associated with SRC and understands how to properly perform the needed components of the physical exam for SRC. Once the diagnosis of SRC is made following current concussion guidelines in the management of SRC including removal from play RTC and RTP guidelines has been proven to improve recovery time in SRC.
References


APPENDIX B:

USABILITY SURVEY FOR EDUCATION MODULE
Usability Survey on Sport-Related Concussions in Youth Education Module

Q11 This survey is to test the usability of the Sport-Related Concussion in Youth for Utah Nurse Practitioners Working in Primary Care education module. Please respond to the following statements and questions regarding the usability and educational value of the module.

○ Acknowledge you understand the purpose of the survey (1)

Q12 Please provide the following information regarding the usability of the education module.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neither agree nor disagree (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The education module was easy to use. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The module was well organized (3)</td>
<td>0</td>
<td>0</td>
<td>○</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The content was at the appropriate reading level (4)</td>
<td>0</td>
<td>0</td>
<td>○</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The content addressed the objectives (5)</td>
<td>0</td>
<td>0</td>
<td>○</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Q13 How long did the education module take you to complete?
○ 30 min or less (1)  
○ About 1 hour (2)  
○ 2 hours or more (3)

Q14 What was the major strength of the education module on sport-related concussion in youth?

Q15 What was the major weakness of the education module on sport-related concussion in youth?
APPENDIX C:

WELCOME EMAIL TO PILOT STUDY
Dear fellow nurse practitioners, I am currently working on my DNP project and need your help. I have developed an online education module on sport-related concussion in youth for NPs working in the state of Utah. I would like to pilot this education module with a small group of NPs working in Utah. The data gathered from this pilot study will help me to improve the module before it is disseminated to NPs in the state.

Participation in the pilot study will take about 1 hour. Participants will complete the online education module on sport-related concussions in youth and then be followed by a brief survey regarding the usability and quality of the module.

The module presents information on the diagnosis and management of sport-related concussion in youth. There are also two tests included in the module. All scores on the tests will not be recorded at this time and will not be available to the research team.

Following completion of the education module an 8-question survey on the usability and quality of the module will be conducted. All survey responses will be confidential and your identity will not be made available to the research team.

If you are willing to participate in this pilot study, please acknowledge your willingness to participate by responding to this email. Once you have acknowledged your willingness to participate in the pilot study a link for the education module and survey will be emailed to you. Thank you for your consideration.

Craig Nuttall MS, FNP-C
Craig-nuttall@byu.edu
801-427-1625
APPENDIX D:

PROJECT DISCLOSURE STATEMENT
The Pilot Study of an Education Module on Concussions in Youth for Primary Care Nurse Practitioners in Utah
Craig Nuttall MS, FNP-C

The purpose of this study is to pilot an education module on concussion in youth for primary care nurse practitioners in Utah for usability and quality.

If you choose to take part in this study, you will be asked to participate in the education module and fill out a short survey on the usability and quality of the module. It will take approximately 60 minutes to complete the module and survey. There are no foreseeable risks associated with participating in this research and you will receive no immediate benefit from your participation. Your participation in this pilot study will help to improve the module to make it more effective at improving concussion care delivered from nurse practitioners in Utah. Survey responses are anonymous.

If you choose to participate in the study, you may discontinue participation at any time without penalty. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant in this study. An Institutional Review Board responsible for human subjects’ research at The University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research. For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at http://rgw.arizona.edu/compliance/human-subjects-protection-program.

For questions, concerns, or complaints about the study, you may call Craig Nuttall MS, FNP-C at 801-427-1625 or email at craig-nuttall@byu.edu

Please click the following link to participate in the education module. The survey is contained in the education module and can be found in the conclusion section of the module.

By participating in the education module and taking the survey you agree to have your responses used for research purposes.

APPENDIX E:

LINK TO EDUCATION MODULE ON SPORT RELATED CONCUSSIONS IN YOUTH FOR PRIMARY CARE NURSE PRACTITIONERS IN UTAH
Final Education Module Link

The following link will grant you access to the education module developed through this DNP project.

Link to module: https://dl.dropboxusercontent.com/u/298492572/Sport-Related%20Concussion%20In%20Youth%20for%20Utah%20NPs%20final%20-Presenter%20output/presentation.html
REFERENCES


