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Educational Professionals' Current Knowledge of Concussions And Return To Learn Implementation Practice

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ABSTRACT

Purpose of Project: The purpose of this study was to determine the knowledge level and return-to-learn concussion management guidelines for secondary school educational professionals. **Methods:** Surveys were distributed to 1,334 middle and high school educational professionals. Surveys included questions regarding basic demographics, teaching and coaching experience, personal concussion experiences, general concussion knowledge, and knowledge of return-to-learn guidelines. **Results:** Survey response rate was 15.7% (N=210). The mean teaching experience was 13.9±8.6yr and 46.4% had previous or current coaching experience. Overall 25.8% of respondents had taken a class/clinic on concussion recognition. Of those that coached, only 49.0% took a class on concussion recognition. No significant relationships existed between those who have coached (p=0.87), previous personal concussion history (p=0.19), or those who had a class/clinic on concussion symptom recognition (p=0.57). Educational professionals correctly identified 87.6% of concussion symptoms on average and correctly identified 71.2% of non-concussion related symptoms. Regarding return-to-learn guidelines, 64.4% were uncertain if their school had a written concussion management protocol to assist teachers in the classroom and 88.7% stated they had no additional education on the topic. In addition, only 44.8% were informed if a student had received a concussion. **Conclusion:** Though knowledge of educational professionals is adequate in identifying concussion symptoms in concussed students, care within the classroom is still under emphasized. Communication is limited and educational professionals are not informed of

concussed students needing potential accommodations. Furthermore, there is a paucity of education in management of such conditions within the classroom.

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Chapter 1 – Introduction

According to the Center for Disease Control (CDC), concussions are an 'epidemic' in the USA (Lebrun, Mrazik, Prasad, Tjarks, Dorman, Bergeron, Munce, & Valentine, 2013). There is an estimated 300,000 mild traumatic sport-related brain injuries resulting in a loss of consciousness that are evaluated in emergency departments in the United States annually (Thurman, Branche, & Sniezek, 1998). This number is well below the estimated total incidence of concussions, which is estimated to be between 1.6 million and 3.8 million concussions (Langlois, Rutland-Brown, & Wald, 2006). While not all of these brain injuries occur in school aged-children, the proper assessment and management of these injuries needs to be addressed in schools. In 2007, high school sport-related concussions alone were estimated at 136,000 in one year, representing 8.9% of all athletic injuries (Gessel, Fields, Collins, Dick, & Cornstock, 2007). This number is also likely to be under-estimated as recent improvements in recognition and education are speculated to have led to increased reports of concussion incidence. The CDC has estimated that for athletes' ages ten to nineteen years, the number of concussions increased by 57% in 2009 when compared with 2001 (CDC, 2011).

Concussions are mild traumatic brain injuries that are not single event injuries affecting only mobility and physical function. Concussions are defined as "a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces." (Grady, 2010; McCrory, Meeuwissee, Aubry, Cantu, Dvorak, Echemendia, et al., 2013). This is revised definition that started describing collision injuries between the head and some object at a low force rate with a loss of consciousness (Grady, 2010). The

most recent definition describes a process affecting cognition that does not require a loss of consciousness to occur since less than 10% of concussions have a loss of consciousness. Other signs and symptoms associated with concussions include, dizziness, light-headedness, fatigue, headaches, nausea, blurry vision, sensitivity to light and/or noise, feeling in a fog, confusion, retrograde/anterograde amnesia, or loss of consciousness (Grady, 2010).

Concussions typically resolve within seven to 10 days depending on the severity (Putukian, 2011). However, several factors influence the resolution period. Some of these factors include age, concussion history, gender, and comorbid conditions (Grady, 2010). The younger the athlete, the longer recovery time post-concussion. Adolescents typically recover within 10 to 14 days. Also, an athlete with previous concussions, especially three or more, will have a longer recovery time and higher rate of future injury than those with only one concussion (Grady, 2010). This is concerning considering that approximately 13.2% of concussions are recurrent with 3.1 reported per 100,000 athletic exposures (Castile, Collins, McIlvain, & Comstock, 2011). In addition to increased symptom duration, recurrent concussions increase the cognitive deficits as does gender. While further studies are needed to determine severity of concussion between genders, women usually see greater deficits in reaction time and higher rates of self-reported symptoms (Grady, 2010).

With increased cognitive symptom duration, school-aged children with concussions will be returning to learn before full recovery. The return to learn is a necessary component of the recovery process, however, this puts the burden of managing concussions and concussion symptoms on non-healthcare professionals as educators are

required to work with students suffering from a head injury more frequently (Halstead, McAvoy, Devore, Carl, Lee, & Logan, 2013). To further complicate this process, the cognitive stresses, such as schoolwork or a job, will often increase symptoms reports following concussions (Grady, 2010). The increased cognitive stresses can increase the resolution period.

During school, symptoms may be increased, causing concussed students to be frustrated. Cognitive deficits and behavioral problems are associated with concussions in some cases. Recent studies have shown that students with behavioral issues following a concussion perform poorly in school, while their counterparts succeed (Hawley, 2004). Cognitive rest is important in preventing this bad behavior and in returning to learn in a timely manner. By understanding concussions, teachers can appropriately reduce the amount of cognitive stimuli during the recovery process (Halstead, et al., 2013). A gradual return to cognitive activity is imperative in decreasing total recovery time from a concussion (McLeod & Gioia, 2010).

In order to provide appropriate interventions for concussed students, signs and symptoms must be monitored daily (Halstead, et al., 2013). Concussions affect individuals' sleep patterns, which lead to decreased alertness and trouble staying awake in the classroom (Sady, Vaughn, & Gioia, 2011). Increased sleep disturbance will ultimately lead to higher anxiety, which will negatively affect students' cognitive limits. Concussed students typically try to "work through" their symptoms because they are anxious if they miss class or assignments, that their grades will be hindered (Sady, et al., 2011). The increase in anxiety and decrease in alertness puts unnecessary stresses on the

teacher; however, if an educational professional is knowledgeable on concussions before an incident occurs, they can reduce the complications and provide correct management.

In sporting events, athletic trainers are usually the first responders to a concussion, and it is their responsibility to properly manage the concussion both on and off the field. On the field, return to play decisions are made by the athletic trainer; however, return to the classroom setting also needs to be considered for concussion management. Return to learn should be the top priority of the educational professionals when dealing with students with concussions. Off the field the athletic trainer should inform all school personnel of student-athletes with concussions (McGrath, 2010; McLeod & Gioia, 2010). Return to cognitive activities must be completed prior to beginning the return to physical play program (McLeod & Gioia, 2010). The return to learn process is determined by the parents and the academic team. This process should be individualized to the student (Halstead, et al., 2013).

Many school personnel affect the cognitive recovery of students; either positively or negatively. These personnel include the school nurse, athletic director, guidance counselor(s), teachers, and team physician (McGrath, 2010; McLeod & Gioia, 2010). The return to learn process includes many different teams. The family team includes the parents, peers, teammates, other family members, and the student. The family teams role is to encourage rest and decreased stimulation. The medical team consists of the emergency department, primary care physician, psychologists, and school physicians. The medical team should perform the initial evaluation and determine the recovery plan. The academic team includes the teachers, counselors, psychologists, nurse, and administrators. Their primary role is to create the student's return to learn program. Since

the academic team is installing the return to learn process, it is essential that they are aware of the affects of learning on concussion and the affects of concussion on learning (Halstead, et al., 2013).

The best way for these personnel to assist concussed students is to learn the role that cognitive and physical rest have on recovery in sports and in returning to learn (Halstead, et al., 2013). Schools should implement a management plan that can be available to all staff and faculty and that all staff and faculty are made aware of its existence. It should include information about cognitive deficits that can come from concussion, the need for extra rest, both mentally and physically so the brain can heal, and information about resources to accommodate for concussed students. As concussion symptoms cannot be generalized, management strategies should be specific to the individual athlete. (McLeod & Gioia, 2010). By being in contact with parents, other school personnel, and medical professionals throughout this process, teachers can ensure proper recovery management (CDC, 2013).

The importance of a return to learn program for concussions in high schools should be a high priority for educational professionals. If return to learn is put to the side, students experiencing concussion signs and symptoms could potentially have long-term cognitive problems.

Statement of the Problem

The purpose of this study is to determine the knowledge level and practice of educational professionals in middle and high school settings on return to learn concussion management.

Hypotheses

- Hypothesis 1: Educational professionals' knowledge on general concussion signs, symptoms are inadequate.
- Hypothesis 2: Educational professionals that have had past experience either having a concussion or knowing someone that has had a concussion, have a better understanding of concussion management and treatment suggestions than do those that have not had that experience.
- Hypothesis 3: Educational professionals are not aware of the school policies or lack of policies in concussion management.
- Hypothesis 4: The communication between school team and the medical team is inadequate in relaying medical information that can affect school performance.

Assumptions

It is assumed that the educational professionals will not use any aid in answering the questionnaire and they will be honest with their answers. The researcher can assume that the subjects have either had prior training in concussion management or they have not; therefore, affecting the outcomes of each response. It is assumed that if the participant fails to accurately answer the survey, they are inadequate in concussion knowledge level and practice.

Significance of the Study

This study will provide significant information on whether or not educational professionals are prepared to manage students with concussions in the classroom setting. By determining the knowledge level and practice of these professionals, we will be able to improve the return to learn process.

Chapter 2 – Literature Review

Most high school and middle school educational professionals are not aware of the effects of a concussion on a student's academic performance. High school and middle school students with concussions have many reasons to fail academically; however, many school personnel including the school nurse, school counselors, and teachers do not know the struggle these students undergo. While the athletic trainer is the main source for students to gain information on concussions, school educators should be aware of this information as well in order to improve the resolution period of the concussion (McGrath, 2010). It is not only the athletic trainer's responsibility to inform educational professionals dealing with concussed student-athletes, but it is also those same professionals job to be aware of their students' needs and to accommodate for them. The following literature review will discuss topics ranging from how to implement a program into the classroom setting to the knowledge that the educators themselves have on general concussions and management.

Epidemiology

As stated before, concussions are becoming an epidemic in the United States. Students are becoming injured more and more often and many of those injuries include concussions. Previously, the definition of a concussion was "low-velocity injuries that cause brain 'shaking,' resulting in clinical symptoms, and which are not necessarily related to a pathologic injury" (McCrory, Meeuwissee, Aubry, Cantu, Dvorak, Echemendia, et al., 2013). Concussion knowledge has evolved to the following new definition: "a complex pathophysiological process affecting the brain, induced by

traumatic biomechanical forces" (McCrory, et al., 2013; Kontos, A.P., Elbin, R.J., Lau, B., Simensky, S., Freund, B., et al., 2013). The increase in concussion incidence and the increased knowledge on the mechanics and affects on the brain has broadened the definition of a concussion. Concussion recognition has recently become more prevalent worldwide. This recognition is opening up opportunities for studies on the rates of concussions in different populations and settings.

In the study conducted by Gessel, Fields, Collins, Dick, and Comstock, in 2007, the concussion rate in students in both high school and collegiate sports are examined. The authors wanted to get a representative sample of the United States high schools, which meant gaining participation from schools in different locations and schools of different sizes. Collegiate athletes were not directly measured by this study, but a previous NCAA internet based reporting tool was used to assess concussion rates. The sports used in the study were boy's football, soccer, basketball, wrestling, and baseball, and girl's soccer, volleyball, basketball, and softball. There were no previous studies found that looked at female sports and concussion rates (Gessel, et al., 2007).

There were 100 high schools that participated in the study. Each high school was required to have one or more certified athletic trainers with a reliable email address. The athletic trainers' job was to report injury incidences and athletic exposures in the Reporting Info Online database (RIO). Athletic exposure was indicated by athletic participation in practice or competition. The athletic trainers reported injury location, time, concussion symptoms, resolution time, return to play time, and reoccurrence of concussions, weekly to the RIO. RIO was used to assess the patterns and rates of injuries throughout the 2005-2006 school year (Gessel, et al., 2007).

The results showed that in high schools, there were an estimated 4431 injuries reported, of which 396 were concussions. More specifically, there were 137 concussions in practice and 259 concussions in competition (Gessel, et al., 2007). The average concussion rate was .23 per 1000 athletic exposures. These numbers only include the nine sports listed earlier. The estimation of concussions sustained in all sports in the US is 135,901. Lastly, the resolution of concussion symptoms was in three days or less for greater than 50% of the reported concussions. Headache was the most common symptom, with dizziness and confusion following (Gessel, et al., 2007; Meehan, W.P., D'Hemecourt, P., & Comstock, D., 2010). The study determined that concussions represented 8.9% of all of the high school injuries. Another study determined that of all reported injuries, concussions represented 13.2% (Meehan, et al., 2010). This number is alarmingly large and needs to be focused on more in high school sports and academics.

The previous study only takes into account 100 high schools and nine sports. The review conducted by Langlois, Rutland-Brown, and Wald in 2006, examines traumatic brain injury rates throughout the entire US population. The authors found that the rate of concussion was 1.4 million per year. This number does not include the treatment for brain injuries in settings other than emergency rooms, hospitalizations, and deaths. This means that the actual concussion rates are higher than we might think. The authors determined that there was approximately 1.6 to 3.8 million sports-related concussions annually (Langlois, et al., 2006). This estimation came from the CDC's estimated 300,000 sports-related concussions per year, which only included those injuries with a loss of consciousness (Thurman, Branche, & Sniezek, 1998; Marar, M., McIlvain, N.M., Fields, S.K., & Comstock, D.R., 2012).

These numbers can be further broken down into new versus recurrent concussions in high school athletes. Castile, Collins, McIivain, and Comstock (2011) studied the RIO from Gessel et al's (2007) study previously mentioned and compared the new versus recurrent concussions reported by the ATs. The authors used the information gathered between 2005 and 2010 on the Surveillance system to make the comparisons. This timeline reported 2110 new concussions and 292 recurrent concussions, totaling 2417 sports-related concussions. They found that 22.2 new concussions per 100,000 athletic exposures and 3.1 recurrent concussions per 100,00 athletic exposures were reported (Castile, et al., 2011). Reoccurring concussions are proven to take longer to resolve, thus lengthening the time the athletes are unable to participate in physical activities and in cognitive activities, such as school.

The data collected found that new concussion symptoms, such as headaches, dizziness, and confusion, resolved in one day to one week, while recurrent concussion symptoms resolved in the same amount of time in seven of the sports, not including men's baseball and women's softball. In baseball, 81.7% of the recurrent symptoms resolved in one week to one month, and in softball, 41.2% of recurrent symptoms resolved in greater than one month (Castile, et al., 2011). Athletes reporting more symptoms of concussion than the previously mentioned, had a recurring concussion that took one week to one month to be resolved.

The resolution period for recurrent concussions was greater than one month in 6.5%, whereas only .6% of new concussions resolved in greater than one month (Castile, et al., 2011). The resolution time for recurrent concussions is much greater than that of new concussions. While rates of new concussions are increasing, so are the rates of

recurring concussions, which increase resolution time, return to learn time, and symptom severity (Castile, et al., 2011).

Signs and Symptoms and Effects on Learning

The previously described epidemiology of concussions is dependent upon the signs and symptoms associated with each individual injury. In Gessel, et al's (2007) study on the concussion rates for high school students in the 2005 and 2006 school year, they determined that the most commonly reported symptoms of a concussion were headaches, dizziness, and confusion. While these symptoms are primary indicators of a concussion, many other signs and symptoms are good indicators as well. Some other signs and symptoms include loss of consciousness, which occurs in about 10% of concussions, nausea or vomiting, proprioception problems, double or blurry vision, irritability, fatigue, sensitivity to light or noise, feeling sluggish, foggy, or hazy, concentration deficits or problems, and the feeling of being "down" (Grady, 2010; Saunders, E.A., Burdette, T., Metzler, J.N., Joyner, A.B., & Buckley, T.A., 2013). Additional signs and symptoms that may be associated with previous conditions or other disorders may include sleep disturbances and mood or behavior changes (Harmon, Drezner, Gammons, Guskiewicz, Halstead, et al., 2013; Sady, Vaughn, & Gioia, 2011; Hawley, C.A., 2004).

All of the signs and symptoms can have an effect on learning. In the article written by Sady, et al., in 2011, the authors indicate that anxiety can be a factor in the resolution time of a concussion. Students want to be able to return to learn and play as soon as possible, causing frustration when their symptoms are not resolved. Learning is affected by concussions that have symptoms of memory loss, decreased attention, and

decreased processing speed (Sady, et al., 2011). The authors relate the affects of anxiety after a concussion and cognitive deficits seen. Anxiety is increased after concussion, therefore, the student will be more resistant to treatment protocols. The school environment can increase these bad behaviors (Hawley, 2004). Schoolwork assigned increases the anxiety and symptoms in students so that students try to "work through" those symptoms (Sady, et al., 2011).

Sady, et al. (2011), also describe the effects of learning on a concussion. This means that returning to learn and play too soon worsen the symptoms and can lengthen the time to full recovery. It is widely known that returning to play too soon will exacerbate the symptoms, but it is not well known that returning to learn too soon will also exacerbate those same symptoms the same way, if not worse. The return to learn process should be the top priority for students with concussions. Students can return to learn more effectively if they are careful about the amount of cognitive stimuli they receive. This process begins with cognitive rest (Sady, et al., 2011).

Learning or cognitive activities, can also affect concussion. This means that even though the student may want to push through the classroom lectures and assignments, the brain is exhausted and does not want to function cognitively. When the student does not decrease cognitive activity, the students' symptoms will become worse resulting in an extended recovery period (Sady, et al., 2011). Individuals all have different recovery times and symptoms during recovery. Some symptoms will be present during the initial stage of a concussion while others will arise later in recovery. Individuals need to be treated depending on the symptoms they have. This could mean that an individual cannot participate in any type of cognitive functioning such as school work or reading, yet

another individual may be disturbed by environmental factors such as lighting, noise, or cell phone (Sady, et al., 2011).

In a study performed by Smits, Dippel, Houston, Wielopolski, Koudstaal, Hunink, and Lugt (2009), 21 patients with a concussion were tested with a MRI, and other tests assessing working memory/vigilance, and selective attention. The results for the working memory showed that performance levels decreased significantly as the working memory load increased (Smits, et al. 2009). Post concussion syndrome after a concussion was highly correlated with an increase in brain activation in working memory and selective attention. These results show that when the brain is activated at higher levels, symptoms such as headaches, dizziness, irritability, sensitivity to light, etc., are increased, which in time will slow down the recovery time following a concussion (Smits, et al., 2009).

Attention deficits also affect the abilities of a concussed student to reach their highest potential in their education. The study conducted by Yeates, Armstrong, Janusz, Taylor, Wade, Stancin, and Drotar (2005), examined children with TBIs and its affects on their cognitive abilities and behaviors in attention and the relationship between the two. The participants that were included in the study were 132 children, 41 with severe TBI, 41 with moderate TBI, and 50 with orthopedic injuries (Yeates, et al., 2005). Cognitive abilities were assessed using the WISC-III or the WAIS-III and long-term attention problems were assessed using the Child Behavior Checklist (CBCL) and ADHD rating scale (Yeates, et al. 2005). The results showed that children with a TBI had significant increases in attention problems. Cognitive functioning was also impaired in children with concussions; however, not in children with orthopedic injuries (Yeates, et al. 2005).

Attention and cognitive deficits can also hold an impact on a students' social and academic outcomes. The study performed by Arroyos-Jurado, Paulsen, Merrell, Lindgren, and Max (2000), determined which factors, premorbid ability, age, severity of the injury, and academic/social outcomes, would predict the academic outcomes two years post-concussion. Forty-three children and adolescents with a history of TBIs were assessed in academics and social skills. The study showed that children with a history of TBI often have academic issues; however, those children that do not have academic problems may likely have issues with social interactions (Terrell, T.R., Cox, C.B., Bielak, K., Casmus, R., Laskowitz, D., & Nichols, G., 2014). The results determined that often TBI severity can predict social functions more than academic performance (Arroyos-Jurados, et al. 2000). Traumatic brain injuries that occur in childhood or adolescents can have affects not only on immediate years following injury, but also on adulthood years. If action is not taken immediately following a TBI to decrease the recovery time with the use of interventions and appropriate management protocols both physically and cognitively, TBI children may suffer in academics and social outcomes for the rest of their lives (Arroyos, et al. 2000).

Cognitive and Physical Rest

Appropriate rest is required for faster recovery time after a concussion (Guerriero, R.M., Proctor, M.R., Mannix, R., & Meehan III, W.P., 2012). Types of rest and duration of rest are discussed in a study performed by Sullivan, Alla, Schneiders, Ahmed, and McCrory (2012). The researchers created a pilot tested survey and distributed it to 118 physical therapy students. The questionnaire included previous history on concussion signs and symptoms, concussion management knowledge, and rest with concussions. The

survey was administered before and after a lecture period that targeted concussion management and definition and identification. The study revealed that physical therapy students did not fully understand the amount of rest and type of rest that was needed for concussed athletes (Sullivan, et al., 2012).

Prior to the lecture, the participants believed that rest after a concussion did not include exercise, sport, and physical activity. The study showed that many medical professionals do not realize that cognitive rest is necessary for athletes to fully recover in a timely manner. After the lecture, the students were able to fix their responses as needed and showed that they retained the information from the lecture (Sullivan, et al., 2012). Rest is proven by many studies to be necessary; however, the medical and educational professionals that may be working with concussed patients are not familiar with the type of rest, which includes both physical and cognitive rest (McCrory, et al., 2013; Guerriero, et al., 2012).

In a concussion consensus statement written by McCrory, et al. (2013), the management of a concussion was discussed concerning rest periods. Evidence has shown that low levels of exercise after a concussion may be beneficial for patients that have a slow recovery; however, no study has determined when to begin the less intense exercise. The authors made it known that recovery from a concussion may be between seven and ten days; however, recovery time differs from individual to individual (McCrory, et al., 2013). The issue with concussion recovery and diagnosis is that there seems to be no standardized assessment tool used nationwide.

Common Misconceptions

Since the majority of educators are unaware of the severity of concussions, many misconceptions have been proven to be a problem. Participants in a study by Linden, Braiden, and Miller (2013) that determined the knowledge of school educators on concussion management in Northern Ireland were given a questionnaire that covered knowledge, experience, training, and school type. The study showed that the many educators were not aware that children with traumatic brain injuries (TBI) tended to be more easily angered compared to children without the injury. Some educators of whom had more experience in dealing with children with TBI had higher scores than those that have had no experience. The questionnaire showed that 29.4% of the educators believed that when being knocked unconscious, the child does not have any lasting effects and in addition, 43.8% said that they did not know the answer.

Training in concussion management showed an increase in the awareness of educational professionals on the symptoms that concussed patients deal with daily. A reactive style has been the norm for many years in the past; however, a pro-active manner should be the focus of educators (Linden, et al., 2013). The purpose of this is to prevent concussed students from suffering in academics when programs can be put into place to increase the knowledge of educators on how to deal with concussions in the classroom setting.

Another study regarding sport-related concussion management and misconceptions by McLeod, Schwartz, and Bay (2007), provides shocking evidence of common misconceptions regarding concussions in youth coaches. In the study, 250 youth coaches between the ages of 23-60 were chosen to participate. The participants coached

children ages 8-14 years. A questionnaire, which was pilot tested prior to administration, was distributed to each coach. The questionnaire included questions on demographics such as coaching experience, awareness of the signs and symptoms for a concussion, and any certification or trainings completed on concussion management. A scenario was also presented along with four true or false questions on management (McLeod, et al., 2007).

The results showed that coaches with previous coaching education on concussions could recognize signs and symptoms of a concussion better than those without the education (McLeod, et al., 2007; Saunders, et al., 2013). Common symptoms that were not identified include problems with vision, sleep deprivation or disturbances, and nausea. Shockingly, 42% of the participants had the belief that in order for a concussion to have occurred, a loss of consciousness was required. Some participants (32%) believed that a grade one concussion or a mild concussion did not mean that an athlete needed to be removed from play (McLeod, et al., 2007). Although athletes may not present with severe symptoms of a concussion, because the incidence of acquiring another concussion increases with previous concussion history, athletes must be removed from competition after a concussion. These misconceptions can be detrimental to an athlete's future cognitive and physical abilities. Educators need to be aware of the symptoms and severity of concussions on cognitive and physical activities, as well as coaches.

Concussion Recovery

There are many factors that affect the recovery time of a concussion. Some of these factors include age, history of concussions, conditions, and comorbid conditions (Kontos, et al., 2013). The older the individual is, the quicker they will heal from a concussion. On average, high school athletes take 10-14 days to recover completely while

college athletes typically take 5-7 days to recover (Grady, 2010). The number of previous concussions usually increases the recovery time and the rate that another concussion will occur. Studies have shown that three or more concussions increase the risk factor for prolonged recovery, more severe initial symptoms, and incidence of future concussions. A chronic decrease in neurocognitive performance is often associated with a history of multiple concussions (Grady, 2010).

Gender differences affect concussion recovery time. Females generally succeed in verbal memory, but suffer in visual memory when compared to the male athlete following a concussion (Grady, 2010). Female athletes have a greater decrease in reaction time and report their symptoms more often than male athletes. Comorbid conditions contribute to the recovery time and severity of symptoms initially following a concussion. Although studies on high school students with comorbid conditions are limited, studies on adults showed that depression and sleep disturbances increase after a concussion injury (Grady, 2010).

A study conducted by McClincy, Lovell, Pardini, Collins, and Spore (2006), examined the recovery of concussed high school and college athletes. The participants (104) had a previous history of one, two, or more concussions. Ninety-one males averaging 16 years of age and almost 10 years of education were chosen to participate in the study. Each participant had taken previous baseline ImPACT computerized testing along with three tests prior to concussion at two days, 7 days, and 14 days. Sports included football, soccer, basketball, wrestling, hockey, and field hockey. The results determined that all testing categories, which were visual and verbal memory, working memory, processing speed, visual motor skills, and reaction time, had post-concussion

deficits compared to baseline results. The participants did not show symptoms or deficits in the testing parameters after day 14 (McClincy, et al., 2006).

Interestingly, neurocognitive deficits were present at the seven-day testing period. This shows that, contrary to previous studies, concussion deficits may be present longer than one week after concussion. Age was a limitation in the study and could have been a contributor to the statistics calculated (McClincy, et al., 2006). This study provides proof that concussion recovery time is different for individuals and that sports medicine and educational professionals need to be aware of the actual recovery time.

Return to Learn

Resolution time can be minimized if those involved in concussion management are aware of the effects of cognitive and physical rest. In an article written by Halstead, McAvoy, Devore, Carl, Lee, and Logan in 2013, the authors describe in detail what the term "return to learn" entails. If the particular school has a school physician or nurse, they should be the primary contact for a student with a concussion; however, for those schools that do not have those available, Halstead, et al., lists the teams that should be involved in concussion management. The family team includes the student with the concussion, parents or guardians, grandparents, peers, teammates, and family friends. The family team's role is to enforce cognitive and physical rest at home and practice and to decrease stimulation the student encounters, which may include, television, cellphone, reading, or noise. The medical team includes the emergency department, physicians, concussion specialists, and psychologists. The medical team's primary role is to assess and evaluate the extent of the concussion and the recommended treatment for the student. The school academic team has a big role in the return to learn for the concussed student.

The school team includes teachers, counselors, psychologists, social workers, nurse, administration, and school physician (Halstead, et al., 2013).

The primary roles of the academic team are to implement a return to cognitive stimulation plan by providing academic adjustments. Communication with one or more teachers should be made to increase awareness of the effects of a concussion on learning that was previously described. The academic team should be knowledgeable on the ways that cognitive activity can be decreased or altered to decrease the resolution time of the concussion. The authors recommend that 30 to 45 minutes of instruction, with 15 minutes of rest, be implemented into the student's school schedule. During the first few weeks of recovery, the teachers are the main contact with the students, meaning that they must know the ways that they can accommodate for the student within the classroom (Halstead, et al., 2013).

Implementing a Program

Schools are encouraged to implement a program that will consider students with concussions in the classroom just as the athletic trainer implements management protocol when dealing with concussions on the sideline and in the athletic training room. During recovery, it is important for teachers to acknowledge that cognitive deficits are possible following a concussion. Teachers need to be understanding and accommodating for those students. Some ways to do this are to excuse students to miss class, especially during the initial stages of concussion, give the students rest periods throughout the day that may last thirty minutes or so, extend the deadlines for both assignments and tests until the student is symptom free, or extend the time available to take a test (McGrath, 2010).

While these do not seem to be fair to other students, the students with a concussion are at a disadvantage because of the symptoms the concussed athlete may be experiencing.

Athletic trainers' participate in concussion awareness seminars and create concussion management programs to be inserted into the policy and procedures manuals. Teachers and other school faculty members, on the other hand, are not aware of the policies and procedures for a concussion. Concussion education needs to be implemented and required in training for faculty members in a school. In the discussion article by Sady, Vaughan, and Gioia (2011), the authors write about how many states have education and management programs for return to play policies that have been passed by legislation; however, these policies fail to address the recovery of the student-athlete in the classroom setting. Although schools may have written documentation of a concussion management program, because the programs are not reviewed annually or monitored for compliance, they are often forgotten (Sady, et al., 2011).

In an article by McLeod and Gioia (2010), the authors describe the benefit that a student-athlete may gain from partial or full time removal from school activities while recovering and remaining asymptomatic. Concussion management programs should incorporate both physical and cognitive rest into them. Cognition is always functioning unless a person is comatose or asleep, but we can limit the amount of cognitive activity by limiting classroom concentrations for the recovery period (McLeod & Gioia, 2010). Educators may not be made aware of students with concussions in their classrooms. The athletic trainer should make all of his/her colleagues that may deal with the concussed athlete, aware either by email, phone, or personal contact (McGrath, 2010; Linden, et al., 2013). These colleagues may include parents, coaches, athletic directors, school nurse or

counselor, principal, and the teachers. The need to apply an individualized concussion management plan pertaining to rest to each concussed athlete is critical to faster recovery (McLeod & Gioia, 2010).

Just as a physical progression program is implemented into a concussion management plan, a cognitive progression program is important to include as well. Since student-athletes with a concussion are unable to return to play until they are asymptomatic, students will do anything that they can in order to return to play as soon as possible (McLeod & Gioia, 2010). Teachers should not be worried that those students will take advantage of not attending class or having accommodations because the sooner they are back in full cognitive activity, the sooner they can progressively become more physically active. Once students no longer have symptoms of concussion, it is important not to simply throw them back into school. Gradual increase in cognitive exertion may be important in preventing the symptoms from showing up again (McLeod & Gioia, 2010).

Sports Medicine Professionals' Knowledge

Athletic trainers and athletic training program coordinators are important communicators to educational professionals regarding education on concussions (Meehan, W.P., D'Hemecourt, P., Collins, C.L., & Comstock, R.D., 2011). A study performed by Covassin, Elbin III, and Stiller-Ostrowski (2009), tested concussion management guidelines and methods in the clinical and classroom settings. Athletic trainers and program directors were contacted via email at 300 accredited institutions. Five hundred and thirteen participants completed the survey on surveymonkey.com. Participants averaged 11 years of experience and half of them earned MS degrees. The survey included 17 questions that incorporated the areas of demographics, assessment of

a concussion, National Athletic Trainers' Association (NATA) position statement use, and return-to-play (RTP) guidelines (Covassin, et al., 2009).

Results showed that a variety of methods were used for concussion assessment; however, more participants used a clinical examination rather than a symptom checklist, concussion grading scale, SAC test, or computerized test (Covassin, et al., 2009). Interestingly, the NATA position statement on concussion management and assessment was only taught 80% of the time during clinical rotations and in the classroom even though ATs are supposed to follow NATA guidelines. After the participants were shown the Vienna Guidelines for concussion assessment and management, the majority preferred those guidelines to NATA guidelines. The Vienna guidelines use simple and complex to diagnose the severity of a concussion rather than the previously used grading scale (Covassin, et al., 2009). Finally, the practitioners currently teaching and providing care to athletes need to be aware of the different methods used to assess a concussion; however, the standard assessment tool would be more efficient in diagnosis.

Educational Professionals' Knowledge on Concussion

Athletic trainers are often the first medical professionals to assess a concussion; however, concussion management, as discussed earlier, includes more than simply the medical staff. Teachers play an important role in the recovery period of a concussed student-athlete. In a study performed by Hawley, Ward, Magnay, and Mychalkiw (2004), 139 children with a traumatic brain injury (TBI) were mailed a postal questionnaire. The children, primary teachers, and parents were interviewed over behavior, emotion, cognitive performance, physical issues, sensory deficits, movement, and schoolwork and problems associated with school. The results showed that according to the parents of

concussed student-athletes (82.1%), their child's teachers were aware of the TBI. Interestingly, the teachers (31%) reported that the school was not informed of the TBI (Hawley, et al., 2004).

It is, most often, the athletic trainers or other medical professionals' job to inform both the parents and the school of any injuries that may have an affect on learning capabilities. The results of this study say that the schools were made aware of the concussion by parents 50.7% of the time and by a hospital and other agencies only 13.5% of the time. If schools are not being informed of a child's TBI, it is affecting the child's learning abilities and success (Hawley, et al., 2004). School policies may be put in to place; however, if there is a lack of communication between the school and medical staff, special arrangements cannot be made and recovery time may be lengthened.

Educational professionals may be made aware of a student's concussion; however, this will not help if the knowledge level on concussion management is minimum. Examination of speech language pathologists' knowledge on general concussion signs, symptoms, and epidemiology and management were assessed using a 65 item survey (Stuck, 2012). The survey included basic concussion knowledge questions, management of concussions, referrals, and assessment of concussions. The participants reported that most received training on concussion either in college coursework or continuing education courses. The participation in training did not have a significant effect on the accurateness of the general concussion answers (Stuck, 2012). While this study was conducted in speech language pathologists, the importance of educational professionals' knowledge accuracy on concussions and their management is imperative in appropriately returning a student to school.

Legislation

The recent literature as summarized above has discussed concussion management protocols both in educational institutions and athletic training settings. Educational professionals' knowledge on concussion management and the affects of a concussion on cognitive and physical activities has been proven to be very minimal. Although most schools have a concussion policy and procedure manual documented, because these teachers are not trained or made aware of its location or existence, it becomes unnecessary. Changes need to be made in communication techniques between athletic trainers and teachers to increase the awareness of concussion affects and treatment protocols.

Chapter 3 – Methods

The high incidence of concussions in middle and high school students requires many changes in athletics and in the classroom. This research study included a questionnaire that aims to assess educational professionals' knowledge level and practice at the middle and high school level regarding return-to-learn following concussion injuries. Educational professionals (teachers and administrators) who have the potential to be in contact with concussed students and work in either the middle or high school settings were asked to participate in the study. The questionnaire was compiled from various questionnaires used in previous research and was tailored to the population in the study. The questionnaire was a compilation of the following surveys or studies: Common Misconceptions about Traumatic Brain Injury (CM-TBI: r = .75; 2013), Rosenbaum's (2010) survey examining knowledge about and attitudes towards concussion in high school athletes, Weber's (2012) concussion knowledge in the UK general public, Saunder's (2013) knowledge of coaching education students, Broglio's (2010) concussion occurrence and knowledge in Italian soccer, and a mixture of Stuck's (2012) concussion knowledge of speech language pathologists and Hux's (1996) study. The questionnaire was changed accordingly to increase face validity and reliability.

Participants

This study included educational professionals from middle and high school settings. In order to participate in the study, participants had to be educational professionals who had the potential to work with concussed students throughout the school day. Educational professionals included school administration, athletic director,

teachers, and school counselors working at the time of data collection. Participants were excluded from participation if they served any role as medical staff for the school; including, but not limited to the athletic trainer, school nurse, and psychologist.

Instruments

The data for the study was collected via an online survey tool (surveymonkey.com). The survey used was a modified compilation of previous studies on concussion knowledge level and practice, to assess the knowledge of the participants on cognitive and physical rest following a concussion injury as well as each participant's understanding of return-to-learn guidelines and best practices. The questionnaire, Concussion Knowledge and Return-To-Learn Practices Survey, was created with the use of previous valid and reliable questionnaires. This modified instrument consisted of Likert scale, fill-in, and yes or no formatted questions. The Likert scale used was a 5 point scale, including the labels "strongly agree", "agree", "unsure", "disagree", and "strongly disagree." Along with Likert scales for general concussion knowledge and management questions, demographic questions were asked at the beginning of the survey. Demographic questions included age, gender, education level, years of teaching experience, area of teaching, and past experiences with concussions. The content associated with the Likert scale on the questionnaire included items addressing common truths and misconceptions associated with concussion knowledge and best practices. Common signs and symptoms knowledge was assessed using a multiple answer question.

Lastly, the survey included a referral section, asking policies and procedures of managing students with concussions. Participants were asked about the type of training

received, if any, and what types of recommended classroom accommodations needed for concussed students (Appendix A).

Reliability/Validity of Instruments

Previous concussion practice surveys have not been established as reliable or valid currently, besides face validity. The survey used for the study was comprised of portions of 8 surveys and involved three different sections.

The first section asked for basic demographic information and professional experiences. Demographic information that will be asked includes age, gender, education, and years of teaching experience (Broglio, 2010). Professional experience questions asked were training on concussion, concussion diagnosis, students or family members they have worked with whom have had a concussion, classes or areas of study, and coaching experiences (Broglio et. al., 2010; Hux, Walker, Sanger, 1996).

The second section has 19 Likert Scale questions and one multiple answer question concerning general concussion knowledge and terminology and was made up of seven different surveys. The first ten questions asked were from the survey created by Stuck (2012) and Hux (1996). Stuck's survey was considered to have face validity after testing eight different people and revising the questions as needed. Question number 11 and 12 were taken from Saunder's survey created in 2013, which also had face validity. The remaining questions were pulled from the following surveys on concussions: Weber in 2012, Rosenbaum in 2010, Broglio in 2010, and Linden in 2013.

The last section included ten referral or management type questions. The referral section was developed from the survey by Stuck. Items included in this section concentrated on concussion management in the schools, which involves classroom,

administration, and the school district. Most of the questions were Yes, No, or Uncertain. Certain questions that were answered Yes or No, included an extra question to clarify the answer. The last question was an open-ended question on classroom accommodations needed for concussed students.

Procedures

A link to the survey was distributed by email after being granted permission by the school administration. An appropriate administrator signed a provided letter of support (Appendix B) prior to data collection.

Middle and high schools included grades six through 12. The schools were identified via online district websites. Once the schools were determined, a letter of support was sent to the head principal or other administration in order to grant permission to distribute the questionnaires. Once permission was granted, an email was sent to all eligible participants. Participants were informed of the study, given an explanation of the study, and were given the option to reply to the survey or to reject the survey through the use of an informed consent letter (Appendix C). The participant gave consent if they completed the survey. Participants received a second email, one week after the original distribution of the survey, reminding them of the importance of filling out the survey.

The questionnaire was created from the previously mentioned surveys and transferred to an online survey instrument prior to email distribution. The email sent to the participants included a link to the questionnaire, which, once submitted, was added to the data collection. The participants were informed that the questionnaire should only take about 10 minutes to complete. Participants were assured that their responses were to remain anonymous. The participants were not identified by school or district and were

only used for data analysis and results. After data collection, survey responses were downloaded and organized using Microsoft Office Excel (Redmon, WA) and analyzed using IBM SPSS 21.0 (Chicago, IL).

Data Analysis

Descriptive statistics were utilized to describe the population, knowledge of concussion, and current practices of return-to-learn following concussions. When appropriate, the Chi-Square, χ^2, statistic was used to compare knowledge level of concussions between those with previous experience with concussions and those without experience.

Chapter 4 – Manuscript

Abstract

Purpose of Project: The purpose of this study was to determine the knowledge level and return-to-learn concussion management guidelines for secondary school educational professionals. **Methods:** Surveys were distributed to 1,334 middle and high school educational professionals. Surveys included questions regarding basic demographics, teaching and coaching experience, personal concussion experiences, general concussion knowledge, and knowledge of return-to-learn guidelines. **Results:** Survey response rate was 15.7% (N=210). The mean teaching experience was 13.9±8.6yr and 46.4% had previous or current coaching experience. Overall 25.8% of respondents had taken a class/clinic on concussion recognition. Of those that coached, only 49.0% took a class on concussion recognition. No significant relationships existed between those who have coached (p=0.87), previous personal concussion history (p=0.19), or those who had a class/clinic on concussion symptom recognition (p=0.57). Educational professionals correctly identified 87.6% of concussion symptoms on average and correctly identified 71.2% of non-concussion related symptoms. Regarding return-to-learn guidelines, 64.4% were uncertain if their school had a written concussion management protocol to assist teachers in the classroom and 88.7% stated they had no additional education on the topic. In addition, only 44.8% were informed if a student had received a concussion. **Conclusion:** Though knowledge of educational professionals is adequate in identifying concussion symptoms in concussed students, care within the classroom is still under emphasized. Communication is limited and educational

professionals are not informed of concussed students needing potential accommodations. Furthermore, there is a paucity of education in management of such conditions within the classroom.

Introduction

Concussions are an 'epidemic' in the United States according to the Center for Disease Control (CDC) (Lebrun, Mrazik, Prasad, Tjarks, Dorman, Bergeron…, & Valentine, 2013). The estimated total incidence of concussions is estimated to be between 1.6 million and 3.8 million concussions (Langlois, Rutland-Brown, & Wald, 2006). With high school sport participation at 7,795,658 student athletes reported in the 2013-2014 academic year (NFHSAA, 2014) and concussions occurring at a rate of 2.5 per 10,000 athlete exposures (Marar, McIlvain, Fields, & Comstock, 2012), it can be estimated that a large portion of sport related concussions affect secondary school athletes. Though the effects of a concussion injury can vary greatly and generally resolve within seven to 10 days (Putukian, 2011), the resolution period may be extended for those with a history of concussions and comorbid conditions as well as individuals of various ages and genders (Grady, 2010). Whether acute or chronic, the potential impact beyond sport competition/practice is inevitable.

Concussion symptoms may increase due to cognitive and physical stresses. Some of these symptoms include sleep patterns, which may lead to decreased alertness and trouble staying awake in the classroom, increased anxiety, headache, and sensitivity to light and noise. Despite, concussed students tending to "work through" their symptoms in order to avoid their grades being hindered (Sady, Vaughn, & Gioia, 2011), cognitive deficits and behavioral problems are often associated with concussion.

Return to play is often looked at when students have concussions, but the return-to-learn process is often overlooked. The return-to-learn process is used to decrease the cognitive stresses that school puts on the students. The burden of managing concussions and concussion symptoms during school is put on non-healthcare professionals serving as educators (Halstead, McAvoy, Devore, Carl, Lee, & Logan, 2013). The importance of these educators to implement a return-to-learn program into the classroom setting should be a high priority because it can affect the students' long-term cognitive abilities. If an educator is knowledgeable on concussions before an incident occurs, they can reduce the complications and provide correct management.

Many school personnel affect the cognitive recovery or return-to-learn process of students with concussions; either positively or negatively (McGrath, 2010; McLeod & Gioia, 2010). The academic team plays the largest role in the cognitive recovery of the student, which means that they must be aware of the affects of learning on concussions and the affects of concussion on learning. This team includes teachers, counselors, psychologists, school nurse, and administrators (Halstead, et al., 2013).

The purpose of this study is to determine secondary school educational professionals' knowledge regarding concussions and return-to-learn guidelines/practice.

Methods

Participants

A total of 1,334 secondary school educational professionals (middle and high school) were surveyed. Overseeing county Boards of Education and individual administrators of the schools approved this study as well as the IRB.

Procedures

After receiving permission to conduct the study and collect email addresses off of each individual schools' public website, a link to the survey was distributed by email to each educator. Middle and high schools included grades six through 12. A cover letter was sent via email, along with a link to the survey on surveymonkey.com. Each participant was given the option to opt out of the survey, send a response email to the researcher, or take the survey anonymously. Once the participants submitted the survey, it was added to the data collection anonymously. Participants were assured their anonymity by not including district, school name, or email in the return or decline of the survey. Responses were downloaded and organized using Microsoft Excel (Redmon, WA) and analyzed using IBM SPSS 21.0 (Chicago, IL).

Statistical Analysis

Descriptive statistics were utilized to describe the population, knowledge of concussion, and current practices of return-to-learn following concussions. When appropriate, comparative and correlation analyses were utilized to describe differences and relationships between groups and variables, respectively. The Chi-square statistic was used when comparing the knowledge level of concussions between those with previous experience with concussions and those without experience.

Results

Among the 1,334 surveys emailed to the educational professionals, 230 were completed (17.2%). Of the 230 returned, 20 participants did not respond to the majority of the survey and were therefore excluded from the analysis; leaving 210 participant surveys for data reduction. Table 1 below shows the percentages of the participant's age,

gender, and highest level of education completed. The educational professionals' mean age was between 35 and 44 (32.2%, n=68) years; however, ages 25 to 34 (28.9%, n=61) and 45 to 54 (25.6%, n=56) had high response rates as well. The majority of the participants were female (68.7%, n=145) and completed a Master's or Professional Degree (86.7%, n=183). The participants years of teaching experience was between 0.5 and 38 years (M=13.9; SD=8.6).

Table 1
Participants' Age, Gender, and Highest Level of Education

		Percentage
Age:	18-24	2.80%
	25-34	28.90%
	35-44	32.20%
	45-54	25.60%
	55-64	9.50%
	65-70	0.90%
Gender:	Male	31%
	Female	69%
Highest Level of Education Completed:	Some College/2 Year Degree	1.90%
	Bachelors	8.50%
	Masters/Professional Degree	86.70%
	PhD, EdD, or equivalent	2.80%

Past Experience

As Figure 1 below illustrates, only 25.8% (n=54) of respondents have taken a clinic or class on concussion recognition, while 73.5% (n=155) had not taken a class or attended a clinic. Figure 2 below shows the number of participants who have been

diagnosed with a concussion. The participants indicated that 14.9% (n=31) had been diagnosed with a concussion; however, when asked if any close family member(s) or friend(s) had been diagnosed with a concussion, 33.0% (n=69) answered yes. The average total amount of concussions the respondent received and family(s) or friend(s) diagnosed with concussions was one (n=15, 7.1%; n= 26, 53.1%, respectively).

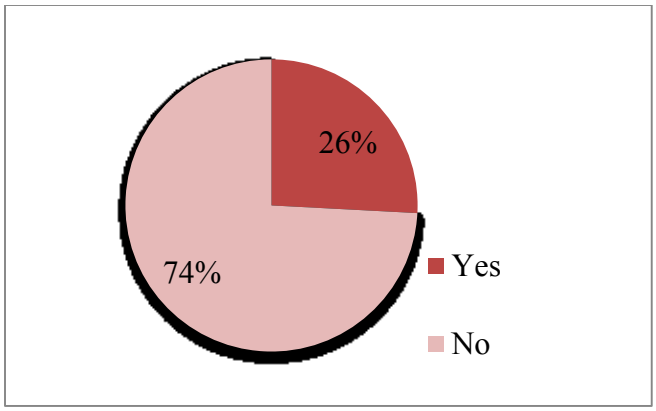

Figure 1. Participants Who Have or Have Not Attended A Class or Clinic On Concussion Recognition

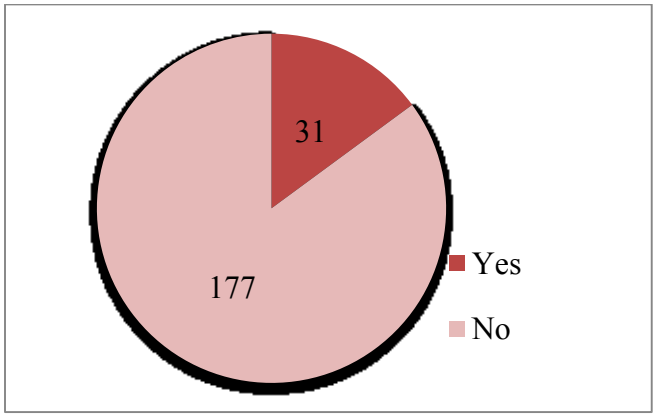

Figure 2. Participants Who Have Been Diagnosed With A Concussion Versus Those Who Have Not

When asked how many students with a concussion the participants have worked with in an academic setting, 63.2% (n=132) indicated that they had worked with few (1-5) students with concussions. Interestingly, 18.7% (n=39) of the respondents had never

worked with a student with a concussion. The majority of the respondents had never coached (n=112, 53.6%), while 46.4% indicated that they either currently coach or have in the past (n=97). The respondents' years of experience of coaching varied from 1-31 years, with an average of 9.5 years (n=60, SD=7.93). When asked if the educational professional had ever taken a sports safety course, 55.9% (n=118) had not taken a course and 44.1% had taken a course (n=93). Since it is required or highly recommended that coaches take a sports safety class, this is not surprising to see.

Concussion Knowledge

The respondents were asked to rate themselves on their knowledge about concussions and their responses varied from novice to expert on a ten-point scale. The majority rated themselves at a 6 (17.1%), which is just over neutral. Just 0.9% (n=2) of respondents indicated that they were experts, while 5.7% (n=12) indicated that they were a novice.

The survey included 18 Likert scale statements regarding general knowledge of concussion, which the participants indicated the strength of agreement or disagreement. Table 2 below shows the percentage of responses for each of the 18 items. Strongly agree and agree and strongly disagree and disagree were combined into "agree" and "disagree."

Table 2

Participants' Knowledge on Concussions

Statement	*Agree*	*Uncertain*	*Disagree*
Loss of consciousness is required for a diagnosis of concussion	7.10%	8.10%	84.80%
Concussion is equally common in males as it is in females	43.80%	30.80%	25.50%
Concussion affects males and females differently	28.90%	41.70%	29.40%

Table 2 (continued)			
Statement	*Agree*	*Uncertain*	*Disagree*
Recovery from a concussion is complete when the individual is asymptomatic	6.20%	19.10%	74.70%
Concussion can affect academic performance	98.60%	1.40%	0.00%
Cognitive rest is important for recovery from a concussion	84.30%	10.50%	5.20%
"Cognitive" refers to thinking processes such as memory, attention, and learning.	98.10%	1.90%	0.00%
Physical rest is important for recovery from a concussion	90.60%	8.10%	1.40%
Concussed students should be eligible for accommodations such as specialized instruction or other educational accommodations.	67.80%	25.60%	6.60%
Multiple concussions are required to observe long-term cognitive deficits	18.50%	24.60%	56.90%
A repeated concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems	90.90%	8.60%	0.50%
Following a concussion, an athlete can return to play as soon as he or she feels okay	3.90%	3.80%	92.40%
Memory loss needs to occur for a head injury to be considered a concussion	3.30%	6.20%	90.50%
A concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things	21.50%	30.50%	48.10%
Symptoms of a concussion can last for several weeks	93.30%	6.70%	0.00%
It is common for individuals to experience changes in behavior after a concussion	77.20%	18.90%	3.90%
Getting your "bell rung" or sustaining a "ding" is the same as experiencing a concussion	14.40%	33.20%	52.40%
Once a person recovering from a concussion feels "back to normal", the recovery process is complete	1.90%	9.00%	89.10%

Respondents indicated all of the symptoms that they associate with a concussion. Respondents were correct at identifying 87.6% of the symptoms associated with

concussions; however, the average score for correctly identifying concussion symptoms and non-concussion symptoms was 71.2% (SD=24.02).

No relationship existed between the percentage of correctly identified concussion symptoms (r=-0.02) and either years teaching or years coaching (r=-0.17). Table 3 illustrates the relationship between those who have attended a class or clinic on concussion recognition and those who have not attended.

Table 3

Participants' Influence on Concussion Knowledge in Concussion Training versus No Training

	Training			*No Training*		
Statement	*Agree*	*Uncertain*	*Disagree*	*Agree*	*Uncertain*	*Disagree*
***Loss of consciousness is required for a diagnosis of concussion**	7.40%	0.00%	92.50%	7.00%	10.30%	82.50%
Concussion is equally common in males as it is in females	53.70%	20.30%	25.90%	40.70%	34.20%	25.00%
Concussion affects males and females differently	27.80%	33.30%	38.90%	29.00%	44.50%	26.50%
Recovery from a concussion is complete when the individual is asymptomatic	11.10%	16.70%	72.20%	4.60%	20.30%	75.20%
Concussion can affect academic performance	100.00%	0.00%	0.00%	98.00%	2.00%	0.00%
Cognitive rest is important for recovery from a concussion	85.20%	3.70%	11.10%	83.80%	13.00%	3.20%
"Cognitive" refers to thinking processes such as memory, attention, and learning.	100.00%	0.00%	0.00%	97.40%	2.60%	0.00%
Physical rest is important for recovery from a concussion	94.40%	3.70%	1.90%	89.00%	9.70%	1.30%
Concussed students should be eligible for accommodations such as specialized instruction or other educational accommodations.	64.90%	22.20%	13.00%	68.40%	27.10%	4.50%
***Multiple concussions are required to observe long-term cognitive deficits**	31.50%	9.30%	59.30%	13.50%	29.70%	56.80%
A repeated concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems	96.30%	3.70%	0.00%	89.60%	9.70%	0.64%
Following a concussion, an athlete can return to play as soon as he or she feels okay	1.90%	0.00%	98.10%	4.60%	5.20%	90.20%
***Memory loss needs to occur for a head injury to be considered a concussion**	1.90%	0.00%	98.10%	3.90%	8.40%	87.70%
A concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things	27.90%	22.20%	48.10%	19.30%	32.20%	48.40%
Symptoms of a concussion can last for several weeks	96.30%	3.70%	0.00%	92.20%	7.80%	0.00%
It is common for individuals to experience changes in behavior after a concussion	77.30%	17.00%	5.70%	76.80%	19.90%	3.30%
Getting "your bell rung" or sustaining a "ding" is the same as experiencing a concussion	24.10%	22.20%	53.70%	11.20%	37.50%	51.30%
Once a person recovering from a concussion feels "back to normal", the recovery process is complete	1.90%	5.60%	92.60%	1.90%	9.70%	88.30%

*Indicates a significant difference between groups

There was not a significant relationship between those who have attended a class or clinic on concussion recognition and general knowledge on symptoms on the Likert Scale. Table 3 above shows a significant relationship when disagreeing that multiple concussions are required to observe long-term cognitive deficits ($p=0.007$, $\chi^2=14.15$) and if memory loss needs to occur for a head injury to be considered a concussion ($p=0.007$, $\chi^2=12.03$).

The relationship between coaching experience and the disagreement of the Likert scale statements, multiple concussions are required to observe long-term cognitive deficits ($p=0.044$, $\chi^2=9.794$) and a concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things was significant ($p=0.037$, $\chi^2=10.194$). Significance was not seen between coaching experience and all other general concussion knowledge statements. Overall, previous experiences with concussion, whether it be coaching, personal, family member, or attending a class or clinic, did not have significance in determining the knowledge level of the respondents.

Management/Referral

When asked if the educational professional felt that treatment for concussed students is effective, 34.5% (n=70) responded yes, while 55.2% (n=112) were uncertain. Over 58% (n=119) of respondents were uncertain if their colleagues or school's administration believe that return to learn concussion intervention has educational relevance. Figure 3 below shows the respondents' uncertainty if their school district has written concussion management procedures, protocols, and guidelines to assist teachers in schools (64.4%, n=130). When asked if the respondent was confident in their ability to

provide, manage, or handle concussed students within the classroom, 40.9% (n=83) responded no, while 38.4% (n=78) responded that they were confident.

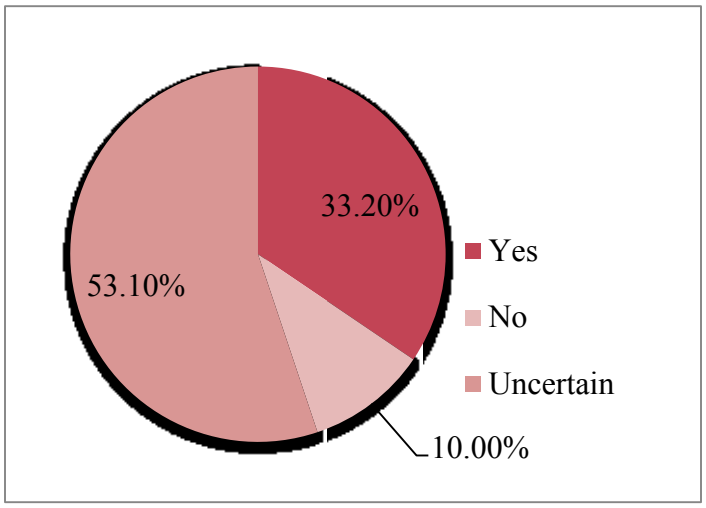

Figure 3. Knowledge of Written Concussion Management Procedures, Protocols, And Guidelines

The respondents were asked if they had ever been provided additional education on concussion management in the classroom setting and only 8.4% (n=17) indicated that they had been provided additional education, while 88.7% (n=180) responded that they had not been provided education. Eight respondents indicated that they were provided an in-service or professional development seminar, 6 respondents indicated that they were provided a class or seminar devoted specifically to concussion, 3 respondents attended a workshop (half-day or more), and one person attended a survey class on disabilities. Other respondents indicated that the athletic trainer, doctor, or nurse provided important concussion information and instructions, while one respondent was emailed an article on concussions.

Most educational professionals are notified when students sustain a concussion at or away from school (n=91, 44.8%), but 38.4% (n=78) are not notified (Figure 4). Those

that were not notified were asked if they think that they should be notified and if they knew who was notified. Respondents indicated that they should be notified (n=67, 87.0%), but did not know who was notified (n=50, 78.1%). When asked how long after the injury the respondents receive notification, 65.7% (n=90) responded that they received notification within 1-7 days (Figure 5).

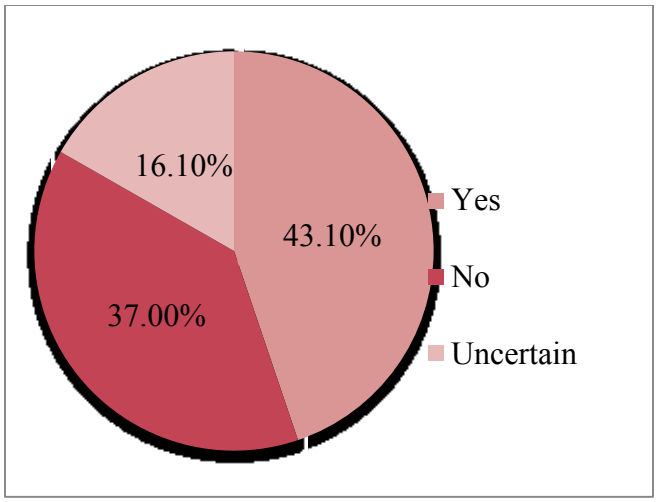

Figure 4. Notification of Students With Concussion

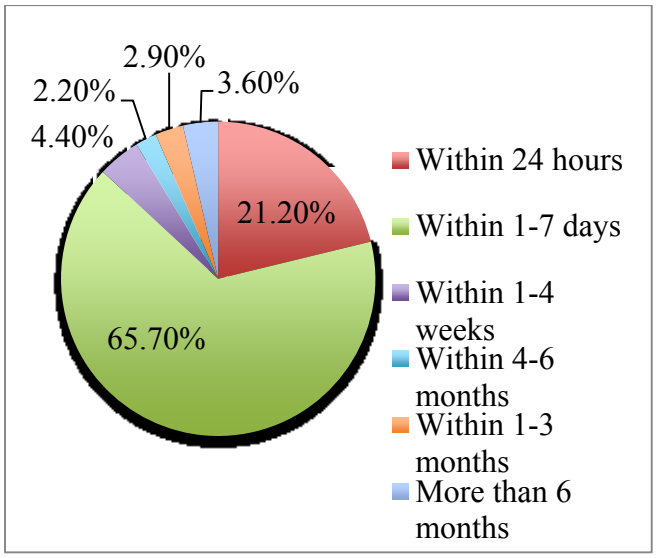

Figure 5. Amount of Time After Concussion, Participant Receives Notification

Discussion

In high school alone, concussions occurred 136,000 times in one year, representing 8.9% of all athletic injuries, while in athletes ages 10 to 19 years, a 100,000 incident increase was seen in 2009 compared to 2001 (Gessel, Fields, Collins, Dick, & Cornstock, 2007; CDC, 2011). Concussion awareness has increased, which means that concussion recognition and incidence rates have increased. Return to learn should be a component in the recovery process of a concussion and should be included in the education an educational professional receives. This is the first study to explore concussion knowledge level and management of educational professionals in middle and high school settings in regards to return to learn guidelines.

Past Experience

The majority of participants showed either no or very little experience with concussions, which may include experience teaching students with concussions, personal diagnosis of concussion, friend or family member diagnosed with a concussion, or taking a class or clinic on concussion recognition. In contrast to previous research, participants who have taken a class or attended a clinic on concussion recognition may have had a slightly better understanding of concussions than those who have not taken a class or clinic (Linden, Braiden, & Miller, 2013). A higher level of uncertainty on concussions was seen in those who have had no previous concussion training. One hundred and fifty-five participants indicated that they had not taken a class or attended a clinic, while 54 participants had taken a class. The participants were not asked when they had taken the class or clinic, which may have contributed to the insignificance between those who have taken a class and those who haven't.

This study suggested that those who have coached did not have increased knowledge overall on general concussion questions when compared to those who have no coaching experience because of the high knowledge of those not coaching. The participants with no coaching experience showed a higher level of uncertainty when answering general concussion questions. Participants were not asked to define how recently they have coached, which may have lead to the lack of difference between those who have coached and those who have not coached. Kentucky's legislation released a new law requiring high school coaches from 2011 and on to attend a sports safety course, which includes concussion recognition and treatment information (KY Rev Stat, 160.445). Interestingly, 46.4% of participants have coached, but only 44% indicated that they had taken a sports safety course. Some of those who have coached may have coached prior to the release of the law, which would account for the lack of difference between those with coaching experience and those without coaching experience.

It is interesting to find that those who have previous experience with concussions do not have increased knowledge of concussions compared to those without previous experience, but worthy to note that those without previous experience illustrated much higher levels of uncertainty. The increased recognition and education in concussions has provided readily available information to those interested in learning more about concussion, which may account for the lack of difference between the two groups. Without knowing the extent of each participants' experience with concussions, we cannot assume that those with previous experience would have a better understanding of concussions.

Concussion Knowledge

The current study suggests that educational professionals have a good understanding of concussions. Upon closer examination of the Likert Scale responses, some uncertainty was present when asked if students with concussions should be eligible for accommodations (n=54, 25.6%). In agreement with previous research, participants disagreed that multiple concussions are required to observe long-term cognitive deficits (Grady, 2010). While previous research has shown that in order to observe long-term cognitive deficits, three or more concussions must be observed (Guskiewicz, Weaver, Padua, & Garrett, 2000); however, recent studies are showing that only one or two concussions are required to observe those deficits (Grady, 2010; Colvin, Mullin, & Lovell, 2009).

Participants were uncertain of the differences between male and females with concussions. Females have been shown to be at increased risk for concussions (Harmon, Drezner, Gammons, Guskiewicz, Halstead, Kutcher,…& Roberts, 2013). Females have different baseline scores when compared to men, which may lead to worse post-concussion neurocognitive scores for females than males (Grady, 2010). The uncertainty of whether or not concussions affect males or females differently is understandable as more research is needed to determine exact differences; however, some differences are seen in post-concussion testing.

Aside from gender differences, concussions have certain signs and symptoms to look for when diagnosing and treating them. The current study found that participants who have past concussion experience scored slightly higher in identifying both concussion and non-concussion symptoms though statistically insignificant. In

accordance with previous research, the participants correctly identified 87.6% of the symptoms associated with concussions, but were more likely to identify non-concussion symptoms as concussion symptoms as well (Broglio, Vagnozzi, Sabin, Signoretti, Tavazzi, & Lazzarino, 2010; McLeod, Schwartz, & Bay, 2007). Educational professionals may overanalyze the symptoms of a concussed student, which is concerning when making accommodations for the student in the classroom. The lack of knowledge on concussion and non-concussion symptoms can be attributed to the lack of training on appropriate return to learn guidelines.

Management/Referral

The current study suggests that educational professionals are not receiving proper education on concussion management in the classroom setting and proper notice of school policies, procedures, or guidelines regarding concussions. Participants indicated that 64.4% were uncertain if their school district had written concussion management procedures, protocols, or guidelines to assist teachers in schools. Students are being returned to the classroom after a concussion and the educational professionals are not aware of any protocol or accommodations required of those students. The uncertainty of whether or not the school district has a concussion management plan is concerning considering the occurrence of concussions in both high schools and middle schools.

The majority of the participants, 40.9%, were not confident in their ability to provide, manage, or handle concussed students within the classroom. This lack of confidence may come from the lack of concussion education within the classroom. Most participants (88.7%) had never been provided additional education on concussion management in the classroom setting. The lack of education may result in increasing

frustration in return to learn for both the educator and the student (Sady, et al., 2011). Concussed students may have increased frustration, a decrease in grades, increase in bad behavior, and worsening symptoms because the school systems are not implementing appropriate programs and education into the academic regimen. Educational professionals seem to understand that concussions can affect academic performance and may cause changes in behavior, but without knowing the accommodations or protocols put in to place for these injured students, they cannot properly adjust their classroom to best fit the recovering student.

Participants who had received additional education on concussion management more commonly attended a class or seminar devoted to concussion or was provided an in-service or professional development seminar. Although overall concussion knowledge in participants was adequate, knowledge of return to learn policies was insufficient, reflecting an overall neglect of this topic to date in this setting. If the return to learn part of concussion management continues being overlooked, the concussed students can have a more difficult time adjusting back to school, therefore, increasing their chance of worsening academic performance.

Similar to other studies (Hawley, Ward, Magnay, &Mychalkiw, 2004; Stuck, 2012), the current study found that 44.8% of participants were notified when a student sustains a concussion; however 38.4% of participants were not notified. Alarmingly, 18.7% of the participants had indicated that they have never worked with a student with a concussion, which could indicate a lack of knowledge or notification of who has worked with a concussed student. Considering the number of concussions per year in middle and high schools, the low numbers of concussed students in the educational professionals'

classroom is surprising. The lack of communication can be detrimental to the return to learn process for the concussed student(s) (Halstead, McAvoy, Devore, Carl, Lee, & Logan, 2013). Implementation of return to learn programs will prevent this gap in the communication between the medical and academic team. Educational professionals will receive proper notification of any students with concussions in their classroom, therefore, immediately putting the classroom guidelines into affect for that student.

The literature suggests that accommodations should be made for concussed students and that schools should implement a program for those students. In accordance with written concussion suggestions, the participants in the current study recommended some common ideas such as modified assignments, extended time on exams and assignments, reduced workload, and note-taker or copy of notes. Although some participants indicated the knowledge to accommodate for concussed students, because the majority of participants were uncertain if their school district had written concussion management protocols or procedures, we cannot assume that all educational professionals are aware of these accommodations. Additional appropriate accommodations may include decreased light and noise, frequent rest breaks, and even excuse from school (Halstead, et al., 2013).

We cannot assume that return to learn guidelines are not being used at all in the school systems, but with over half of the participants showing uncertainty if their school district had concussion protocols or programs, we can assume that these protocols are being overlooked. Educational professionals have a lot of responsibility in educating students on a wide range of topics, but they also have a responsibility to educate themselves on ways to provide the best learning environment for the students. One way

to provide concussed students with a better learning and recovery environment is to be aware of accommodations or programs these students can access. Not only is it the educational professionals' responsibility to be educated in concussion return to learn guidelines, it is the school administrators responsibility to provide this information. Once the school districts are on board with implementing the return to learn guidelines, then the educational professionals can become educated and begin to implement the programs into their classrooms.

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APPENDIX A:
Concussion Knowledge and Return-To-Learn Practices Survey

Appendix A
Concussion Knowledge and Return-To-Learn Practices Survey

A. Background Information

1) Age: 18-24 25-34 35-44 45-54 55-64 65-70 75 or older

2) Gender: Male Female

3) Education: _____ Some High School _____Master's/ Professional degree
_____High School Diploma _____PhD, EdD, or equivalent
_____Some college/ 2 year degree _____Other
_____ _____Bachelor's Degree

4) How many years of teaching experience do you have? _____ Years

5) Have you ever attended a clinic or taken a class on concussion recognition?

Yes No

6) Have you ever been diagnosed with a concussion? Yes No

If Yes, how many? _____

7) Have any close family member(s) or friend(s) been diagnosed with a concussion(s)?

Yes No

If Yes, how many total concussions were diagnosed? _____

8) Approximately how many students with a concussion have you worked with in a school setting?

_____ None (0) _____Few (1-5) _____Some (6-10) _____Many (11>)

9) What classes or area of study are you currently teaching?

_____

10) Do you currently or have you in the past, coached? Yes No

If Yes, how many years of experience do you have and at what level?

_____

11) Have you ever taken a coaches sports safety course? Yes No

12) Self-rank your knowledge about concussions:

1	2	3	4	5	6	7	8	9	10
Novice									Expert

B. Concussion Knowledge and Terminology

The statements below are generalizations about concussion and do not account for individual differences. For each statement, please indicate your strength of agreement or disagreement with each statement *as a generalization.* If you are uncertain or do not have enough information to provide an opinion about a given statement, mark "Uncertain."

SA	=	Strongly Agree
A	=	Agree
U	=	Uncertain
D	=	Disagree
SD	=	Strongly Disagree

13)	SA	A	U	D	SD	Loss of consciousness is required for a diagnosis of concussion.
14)	SA	A	U	D	SD	Concussion is equally common in males as it is in females
15)	SA	A	U	D	SD	Concussion affects males and females differently
16)	SA	A	U	D	SD	Recovery from a concussion is complete when the individual is asymptomatic.
17)	SA	A	U	D	SD	Concussion can affect academic performance.
18)	SA	A	U	D	SD	Cognitive rest is important for recovery from a concussion.
19)	SA	A	U	D	SD	'Cognitive' refers to thinking processes such as memory, attention and learning.
20)	SA	A	U	D	SD	Physical rest is important for recovery from a concussion.
21)	SA	A	U	D	SD	Concussed students should be eligible for accommodations such as specialized instruction or other educational accommodations.

22)	SA	A	U	D	SD	Multiple concussions are required to observe long-term cognitive deficits.
23)	SA	A	U	D	SD	A repeated concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems.
24)	SA	A	U	D	SD	Following a concussion, an athlete can return to play as soon as he or she feels okay.
25)	SA	A	U	D	SD	Memory loss needs to occur for a head injury to be considered a concussion.
26)	SA	A	U	D	SD	A concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things.
27)	SA	A	U	D	SD	Symptoms of a concussion can last for several weeks.
28)	SA	A	U	D	SD	It is common for persons to experience changes in behavior after a concussion.
29)	SA	A	U	D	SD	Getting your "bell rung" or sustaining a "ding" is the same as experiencing a concussion.
30)	SA	A	U	D	SD	Once a person recovering from a concussion feels 'back to normal', the recovery process is complete.

31) Please indicate all symptoms you associate with concussion (Check all that apply).

____Drowsiness
____Eating more than usual
____Hyperactivity/high energy
____Excitement/happiness
____Fatigue
____Talking more than usual
____Difficulty Concentrating
____Calmness
____Feeling Slowed Down
____Feeling Mentally Foggy
____Nausea
____Dizziness/Balance Problems
____Difficulty hearing
____Headache
____Frustration
____Impatient
____Anxious
____Sleeping More than Usual
____Elation
____Confusion

C. Referral

32) Do you feel that treatment for concussed students if effective?	YES	NO	UNCERTAIN
33) Does your school district have written concussion management procedures, protocols, and guidelines to assist teachers in schools?	YES	NO	UNCERTAIN
34) Do you feel confident in your ability to provide, manage, or handle to concussed students within the classroom?	YES	NO	UNCERTAIN
35) Do you think that your colleagues believe that concussion intervention has educational relevance?	YES	NO	UNCERTAIN
36) Do you think that your school's administration believe that return to learn concussion intervention has educational relevance?	YES	NO	UNCERTAIN
37) Have you ever been provided additional education on concussion management in the classroom setting?	YES	NO	UNCERTAIN

38) If YES, describe the kind of training that you have received:

_____ Class/Seminar specifically devoted to concussion
_____ Survey class on disabilities
_____ Workshop (half-day or more)
_____ In-service or professional development seminar
_____ Other(s) _____

39) Are you notified when students sustain a concussion at or away from school?	YES	NO	UNCERTAIN
40) If No, do you think you should be notified?	YES	NO	UNCERTAIN
41) If No, do you know who is notified?	YES	NO	UNCERTAIN

42) Typically how long after the injury do you receive notification?

_____ Within 24 hours	_____ Within 4-6 months
_____ Within 1-7 days	_____ Within 1-4 weeks
_____ Within 1-3 months	_____ More than 6 months

43) What classroom accommodations need to be made for some concussed student?

_____

_____

_____

_____

APPENDIX B:
Letter of Support for Off-Campus Research

Appendix B

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Department of Exercise and Sport Science
College of Health Sciences
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231 Moberly Building
521 Lancaster Avenue
Richmond, Kentucky 40475-3102
Ph: (859) 622-1887
Fx: (859) 622-1254

Letter of Support for Off-Campus Research

Date

Institutional Review Board:

As an authorized representative of _____, I grant approval for Michelle Kuzma to conduct research involving human subjects at my organization. I understand that the purpose of this research is to determine the knowledge level and practice of educational professionals in middle and high school settings on return to learn concussion management.

I grant permission for this project to involve educational professionals at this institution and I have determined these individuals to be appropriate subjects for this research. I understand that they will be asked to complete a fifteen-minute survey on concussion knowledge level and management via surveymonkey.com.

To support this research, I agree to grant access to the emails of the teachers at this institution to the researcher, in order to distribute the surveys.

Sincerely,

[Name of authorized representative]
[Title]

APPENDIX C:
Informed Consent Letter

Appendix C

EASTERN KENTUCKY UNIVERSITY

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Department of Exercise and Sport Science
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231 Moberly Building
521 Lancaster Avenue
Richmond, Kentucky 40475-3102
Ph: (859) 622-1887
Fx: (859) 622-1254

Informed Consent Letter

Date

Dear Participant:

My name is Michelle Kuzma and I am a graduate student at Eastern Kentucky University. Dr. Matthew Sabin and I are conducting a study to determine the knowledge level and practices of middle and high school education professionals regarding return to learn concussion management in the classroom. By doing this study, we hope to learn if professional educators in schools are aware of the cognitive effects of concussion on student-athletes in the classroom and what general concussion knowledge that they know. Because you are a middle or high school teacher near the Richmond, Kentucky area possibly in contact with students with concussions, I am inviting you to participate in this research study by completing the survey.

The following survey will require approximately ten minutes to complete. The survey consists of Likert Scale questions, Yes or No questions, and one open-ended question. If you choose to participate, please submit the completed survey to the link from surveymonkey.com. Once the survey is submitted, there is no further action to be taken. There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please DO NOT include your name. Copies of the project will be provided to my Eastern Kentucky University thesis chair. If you choose to participate in the study, please answer all questions as honestly has possible. Participation is strictly voluntary and you may refuse to participate at any time.

Thank you for taking the time to assist me in my education. The data collected will provide useful information regarding concussion management and understanding among educational professionals. Completion and return to the survey will indicate your willingness to participate in this study. If you require additional information or have questions, please contact me at the number listed below.

Sincerely,

Michelle Kuzma, ATC