SCHOOL PSYCHOLOGISTS’ KNOWLEDGE AND PERCEIVED COMPETENCE REGARDING CONCUSSION MANAGEMENT IN SCHOOLS

Braelyn Tracy

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SCHOOL PSYCHOLOGISTS’ KNOWLEDGE AND PERCEIVED COMPETENCE REGARDING CONCUSSION MANAGEMENT IN SCHOOLS

A Dissertation
Submitted to the School of Education

Duquesne University

In partial fulfillment of the requirements for the degree of Doctor of Philosophy

By
Braelyn Tracy

May 2023
SCHOOL PSYCHOLOGISTS’ KNOWLEDGE AND PERCEIVED COMPETENCE REGARDING CONCUSSION MANAGEMENT IN SCHOOLS

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ABSTRACT

SCHOOL PSYCHOLOGISTS’ KNOWLEDGE AND PERCEIVED COMPETENCE REGARDING CONCUSSION MANAGEMENT IN SCHOOLS

By

Braelyn Tracy

May 2023

Dissertation supervised by Ara. J. Schmitt, Ph.D

A concussion is a type of traumatic brain injury that can have a serious effect on a young, developing brain. Following a concussion, it is common for children and adolescents to experience difficulties in the school setting. Schools may be the ideal setting to address some of the problems children experience as schools employ some personnel with expertise and experience in assessment and intervention. If return to learn is put to the side, students experiencing concussion signs and symptoms could potentially have long-term cognitive problems. School psychologists play a key role in the prevention and assessment of, and intervention for the difficulties experienced after a student has developed a concussion. One specific way that school psychologists may assist such students is through the implementation of a school-based concussion protocol. Few studies have investigated the role of school psychologists in concussion management or their perceived competence to participate in a
return-to-learn model. This investigation serves as a basis to provide an evidence-based, best practices summary to assist school psychologist with the evaluation and management of concussions and to establish the level of evidence, knowledge gaps, and areas requiring additional research. A 31-item anonymous survey containing questions regarding demographics, knowledge and competence with concussions, and current practices regarding concussion management models was electronically distributed via email and completed by school psychologist (n=179). This research adds to the existing evidence indicating that school psychologists are in a unique position to assist adolescents in returning to school after a concussion. The findings imply that future research should investigate the effects of formal training on concussion treatment behaviors and attitudes.

*Keywords*: youth, concussion, management, school psychologists
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CHAPTER I: INTRODUCTION

Concussions, a type of traumatic brain injury, have received considerable attention from the medical and scientific community over the last several decades. Concussions are induced when the head or body receives a bump, collision, or jolt, causing the brain to rapidly shift back and forth (Centers for Disease Control and Prevention [CDC], 2019a). Traumatic Brain Injury (TBI) is a significant public health problem among youngsters in the United States. This is evidenced by the population's high rate of emergency department visits and the complex consequences that can ensue (CDC, 2019a). According to the CDC (2019a), young children have one of the highest TBI-related emergency department (TBI-ED) visits among all age groups. In 2014, there were approximately 2.87 million TBI-EDs in the U.S., including over 837,000 of these health events among children (CDC, 2019a). Of these, about 75% are classified as concussions. The number of TBI-EDs in 2014 represents a 53% increase from 2006, in which there were approximately 1.88 million TBI-EDs. Many of these injuries occur in children, and many are related to sports and recreation activities. TBIs sustained in contact sports accounted for approximately 45% of all sports-related TBI-ED visits (CDC, 2019a). TBIs resulting from sports and recreational activities have recently become a significant public health problem in the United States.

This attention has been driven, in part, by increased public awareness of concussions in professional and youth sports. While sports promote positive physical, intellectual, and social development, sports participation also poses a risk of injury, including orthopedic injury and TBI-related injuries. An estimated 1.7-3.8 million sports- and recreation-related concussions occur in the United States (U.S.) each year (CDC, 2019a). These findings raise concerns regarding the health and safety of the elementary school, high school, and collegiate athletes who
sustain concussions while participating in sports. These types of injuries can have a detrimental effect on cognitive development and academic achievement. The most important aspects of concussion recovery are identifying when a student is injured, when the student should return to school, in what capacity the student returns, and what adjustments to the student's educational program are required (CDC, 2019a; Davies et al., 2016).

Concussion symptoms (e.g., headache, slowed processing, irritability, fatigue, sensitivity to light and noise) may have a detrimental effect on a student's participation and achievement in the learning environment (Davies et al., 2016; Ransom et al., 2015). Most children with concussions recover in a few weeks, but some may experience symptoms for a month or longer (CDC, 2019b). Making temporary alterations to a child's everyday activities will help him or her return to a regular pattern faster. It is necessary to keep in mind that each concussion and each child is unique; thus, your child's rehabilitation should be tailored to his or her specific symptoms (CDC, 2019b). It is critical for school personnel to be aware of the signs and symptoms of a concussion to make academic accommodations based on the student's symptom profile (Davies et al., 2016). Effective concussion management seeks to enhance a student's recovery while returning them to full classroom activities as soon as possible (Davies et al., 2015).

There is increasing evidence that concussions can have a negative impact on children and adolescents' executive functioning, working memory, and academic achievement in a variety of circumstances, including at home, school, social interactions, and sports/recreation activities (Gioia, 2015; McCroy et al., 2017, Ransom et al., 2015). Specific to schools (Davies et al., 2015), concussion symptoms can affect student learning, engagement, and academic achievement. Cognitive symptoms such as slower processing, for example, can impair a student's
ability to acquire new material, participate in class activities, and finish assignments. Other physical symptoms like headaches, for example, can impair a student's ability to concentrate in class (Davies et al., 2016). Cognitive stresses, such as schoolwork, will often increase symptom reports following concussions. This increased mental stress can extend a student's recovery time; therefore, return to the classroom setting needs to be considered for concussion management.

Returning to the learning environment (i.e., return-to-learn) should be the top priority of educational professionals when dealing with students with concussions. Procedures to return an athlete to the playing field has been studied with great frequency (i.e., return-to-play; Harmon et al., 2013; McCrory et al., 2017), less is known about how to return a child to the classroom successfully. A multimodal strategy to best assist a student's complete recovery and effective return to the learning environment is one of the most empirically supported concussion care approaches (Halstead et al., 2013; McAvoy, 2012; Sady et al., 2011). In this study, I will examine school psychologists' knowledge and competence regarding concussion management. By understanding these factors, a school psychologist may design better, execute, and maintain effective concussion management protocols to help prevent, identify, and manage students' outcomes while recovering from a concussion (Damschroder et al., 2009).

**Significance of the Study**

A significant number of children suffer concussions in the U.S. each year, and these children represent a unique challenge for the public school system. Although the research on educational outcomes of students who have sustained a concussion is in its infancy, it's clear that any type of head injury may result in symptoms that impact a student's performance. Contrary to other children with educational disabilities, such as specific learning disabilities, children who experience a concussion represent a population with acute, immediate, and often short-duration
needs. Concussions can manifest in a variety of ways, necessitating the implementation of school-based concussion treatment practices. There is no single intervention program that exists that appears to meet all the needs of children who suffer from a concussion (Bradley-Klug et al., 2015).

Given school psychologists’ training and frequent contact with students, school psychologists are uniquely positioned to support students suffering from concussion symptoms. With school psychologists' expertise in behavior modification, learning theory, and biological influences on behavior and learning, they can provide collaborative services to teachers, information services to all school professionals, and direct student support for students struggling to succeed in the classroom. As well as providing community outreach to educate families, the community at large, and medical professionals (Chesire et al., 2015).

It is essential to understand school psychologists' knowledge of and perceived competence to engage in school-based concussion management. This study will provide meaningful information regarding school psychologists' knowledge and competence to effectively assist students with concussions in returning and succeeding in the classroom setting. By determining these professionals' knowledge level and practice parameters, recommendations can be made to improve the return to learn process for students with a concussion. I aimed to use this information to develop strategies that redress these needs and facilitate best practice guideline adoption for schools serving students with concussions. Lastly, I conclude with a call to action urging school psychologists to take an active role in identifying, serving, and in some cases providing psychoeducation to prevent concussions and mTBIs.
Statement of Problem

One way to support student's post-concussion is through the implementation of a multi-tiered system of support. A team of school services personnel can share information relating to the student’s concussion, provide ongoing assessments of the student's symptoms and progress, and collaborate with the family to develop an appropriate return-to-learn plan to meet the student's needs (Davies, 2016). The goal of a concussion response and management team is to mitigate symptom intensity and duration while facilitating recovery. Once concussion symptoms have subsided, it is generally suggested that a kid returns to school with academic modifications in place that will last until the student is symptom-free. (Davies et al., 2016; Gioia, 2012; Sady et al., 2011). Unfortunately, there is little empirical evidence addressing school psychologists regarding concussion training, concussion knowledge, and competency in executing concussion procedures. It is also unknown if different factors (degree, career experience, training) predict perceived school psychologist competence to engage in the steps of a school-based concussion management model.

Additionally, research has pointed to the value of including school psychologists in this framework. Based upon training in problem-solving and tiered delivery of services, the school psychologist is an ideal professional in the school to serve as the point person for notification and a liaison for communication and case management across stakeholders (Lewandowski & Rieger, 2009). The skillset that school psychologists already possess makes them appropriate for this role. However, school psychologist do not appear comfortable in this role in working with concussed students; thus, this discrepancy presents obstacles to the study of school psychologists functioning in this capacity (Eftaxas & Canto, 2020).
Purpose Statement and Research Questions

The purpose of this study is to determine school psychologists' knowledge and perceived competence to engage in steps of a school-based concussion management protocol. School psychologists possess specific skills (e.g., problem-solving, consultation) that qualify them to work within a multidisciplinary, multi-tiered return-to-learn system designed to meet the unique needs of students as they reintegrate back into school following a concussion (Baker et al., 2015). School psychologists and other educational experts, on the other hand, have stated that they do not feel fully equipped to detect and intervene with students who have suffered a concussion and that they would want to have undergone more training on the subject (Davies, 2016). Because students with concussions have multiple complex issues that can make the identification process difficult, adequate assessment is crucial.

Unfortunately, many school psychologists receive limited TBI training in their graduate preparation programs (Davies, 2016). In reflection of such issues, I sought to understand school psychologists' concussion knowledge and perceived competence to engage in a concussion management protocol in this study. This research aims to answer the following research questions:

1. What is the current state of school psychologists' knowledge of pediatric concussion/mTBI symptoms and outcomes?
2. Where (i.e., graduate coursework, supervised clinical experience, previous work experience, formal professional development, independent professional development) do school psychologists acquire concussion/mTBI knowledge?
3. How do school psychologists rate their competence to engage in each step of a school-based concussion/mTBI management model?
4. What factors (i.e., concussion/mTBI knowledge score, highest degree, graduate coursework, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development) predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model?

   a. Hypothesis: The factors of concussion/mTBI knowledge score, highest degree, graduate coursework, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development are significant predictors of school psychologists’ perceived competence to engage in each step of a school-based concussion management model.

5. Do school psychologists report having been involved in each step of a school-based concussion management model?

Summary

There is a need in schools across the country for widespread concussion awareness, education, and management programs. A school psychologist is an ideal candidate to assess, monitor, and counsel the student and consult with staff and parents to design appropriate management interventions. The current study is based on the existing literature suggesting school psychologists are most suitable to assist students returning to school after sustaining a concussion. However, there is little evidence to support that school psychologists are comfortable in this role and working with this population; thus, this discrepancy presents a gap in the literature. This study seeks to examine school psychologists' knowledge of concussions and gauge their competence in aiding the school reintegration of students who have sustained a
concussion. Additionally, this study highlights the importance of involving school psychologists in concussion management programs.
CHAPTER II: LITERATURE REVIEW

A lack of research exists regarding the educational outcomes of students who sustain concussions because much of the current literature is based upon data gathered from adults in general and athletes. However, researchers and practitioners are increasingly focused upon youth concussions to reduce concussions through prevention efforts and facilitate concussion recovery through accurate assessment and effective treatment (Bradley-Klug et al., 2015). The foundation of this study is a tiered system that utilizes a return-to-learn protocol consisting of a multidimensional treatment approach (Davies, 2016). This framework focuses on the steps to take once a student has acquired a concussion and provides guidance for the development of comprehensive concussion management programs in schools. The main goal of this research is to understand school psychologists' knowledge of pediatric concussion, their ability to use various approaches, and the factors that determine how competent they believe they are.

Concussion Defined

The terminology used in relation to brain injury is varied and often contradictory. One of the most inconsistent areas relates to the term “concussion” (Ruff et al., 2009). The Centers for Disease Control and Prevention (CDC, 2019a) defines a concussion as being caused by an external force, such as a direct blow or jolt to the head, face, or neck, that causes the head and brain to rapidly shift back and forth. A concussion is a type of mild TBI (mTBI) that results in short-term impairment of neurological function (CDC, 2019a). The terms concussion and mTBI will be considered synonymous and will be used interchangeably throughout this study.

With non-sport-specific concussion research, definitions tend to be study-specific and more generally defined. In contrast, concussion definitions connected to sports or sports-specific research are readily available and well-articulated (Jantz, 2015). A concussion is defined by the
American Academy of Neurology (AAN), a group of neurologists and neuroscience experts, as "a clinical syndrome of biomechanically caused modification of brain function, often impacting memory and orientation, and possibly involving loss of consciousness" (Giza et al., 2013). The American Academy of Neurology’s evidence-based guidelines for evaluating and managing concussed athletes are based on this criterion (Jantz, 2015). The Child Neurology Society, the National Association of Emergency Medical Service Physicians, the National Academy of Neuropsychology, the Neurocritical Care Society, the National Association of School Psychologists, as well as several athletic associations have accepted the phrase.

The 2017 Concussion in Sports Group (CSIG) is a multidisciplinary panel including primary care physicians, neurologists, neurosurgeons, sport medicine physicians, trauma surgeons, and sports psychologists, among others (McCrory et al., 2017). The panel further developed a definition and provided a conceptual understanding of sports-related concussion (SRC) using an expert consensus-based approach. Although provided by professionals with interests in sport, this definition can be used to understand general characteristics of concussion, regardless of origin. McCrory and researchers (2017) reported that The Berlin expert panel modified the previous CISG definition as follows:

“A concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic, and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include: (1) SRC may be caused either by a direct blow to the head, face, neck, or elsewhere on the body with an impulsive force transmitted to the head, (2) SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some
cases, signs and symptoms evolve over several minutes to hours, (3) SRC may result in neuropathological changes. Still, the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies, and (4) SRC result in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases, symptoms may be prolonged” (McCrory et al., 2017, p.6).

Further, the clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (e.g., cervical injuries, peripheral vestibular dysfunction), or other comorbidities (e.g., psychological factors or coexisting medical conditions; Halsted et al., 2018; McCrory et al., 2017).

It is vital that school psychologists know the controversy related to the terminology used when communicating information about youth who have sustained a head injury (Bradley-Klug et al., 2015). There is a lack of agreement regarding the diagnostic definitions of mTBI and concussion, and, perhaps confusingly, the terms are used interchangeably in the research literature. The terminology used in relation to brain injury is varied. This is most apparent in the area of mTBI, in which the terms brain injury, head injury, and concussion are often used interchangeably to describe the same type of injury (McKinlay et al., 2011).

Further complicating matters for school systems and school psychologists who provide services for children with brain injuries is the lack of consistency among terminology and definitions among educational and healthcare providers. This lack of consistency regarding definition and criteria has implications for comparing outcome data or identifying true incidence and prevalence rates for concussion. Additionally, the lack of consistency may also create
confusion for school personnel regarding what the different terms mean and what steps to take following an injury, what symptoms to be concerned about, and when to seek medical attention (McKinlay et al., 2011). As a result, school psychologists must be aware of the terminology issue and encourage all stakeholders to report any form of brain injury, regardless of medical diagnosis (Bradley-Klug et al., 2015). It is critical to be familiar with the current definitions of mTBI and concussion until a unified definition or specific diagnostic distinctions are established (2015, Jantz). Clarification of terms should become part of the communication process when professionals from various systems continue to collaborate (Bradley-Klug et al., 2015).

**Prevalence and Risk of Concussions**

Historically, the overall incidence of pediatric concussions has been challenging to estimate due to underreporting and underdiagnosis. According to the CDC, approximately 2.87 million people sustain TBI-related injuries in the United States each year; about 837,000 of those are children (CDC, 2019a). Of all reported TBIs, 75% are considered mTBI, including concussions (CDC, 2019a; Chesire et al., 2011). However, because many people with mild TBIs do not seek medical help, a more accurate figure could be closer to 3.8 million concussions every year. (Langlois et al., 2006). According to Lewandowski and Rieger (2009), a high school of 1,000 students is expected to have 5-10 pupils with concussions per year.

At any time, about 130,000 students in kindergarten through 12th grade would be expected to have severe enough TBIs to warrant special education services (Glang et al., 2008). However, federal special education census data suggest that only 20% of such students with TBIs receive formal special education services under the category of TBI (U.S. Department of Education, 2013).
Because many people who sustain concussions do not seek medical treatment, accurate estimates of the prevalence of concussions are difficult to calculate (Kirkwood et al., 2006). A pediatric study estimated that between 45% and 65% of patients with concussion were not seen in health care settings (Halsted et al., 2018). To promote a speedy and complete recovery, it is critical to identify and manage these injuries in children and adolescents as soon as possible (Sady et al., 2011). The impact of concussion-related impairment (e.g., symptom, onset, duration) on student functioning can be substantial (Parsons et al., 2013; Vaughan et al., 2013). Through regular contact with children, school professionals are critical to support students who have sustained a concussion. Multidisciplinary team approaches, common in contemporary schools, are needed to best facilitate a student's complete recovery and a successful return to the learning environment (Bradley-Klug et al., 2015).

More research is needed, but preliminary data indicate that young children are at particular risk for adverse effects of concussions. Much of this is related to developmental issues. Davies (2016) has explained that the young brain is underdeveloped when compared to older brains. First, young brains have fewer myelin sheaths, the fatty tissue covering the fiber tracts in the brain, leaving them structurally vulnerable to damage. In addition to neuronal risk, the physical stature of young children also places them at risk for the adverse effects of blows to the head or body. Younger children's heads and brains are proportionally larger when compared to their bodies than those of adults. Then when combined with the weaker necks of young children, particularly females, this extra size and weight means that a child's head cannot withstand the force of a hit the way typical adults can (Davis, 2016).

Concussions can occur for a variety of reasons, such as falling or being struck by an object. Many concussions occur due to athletics; however, concussions can also occur as a result
of recreational activity, motor vehicle collisions, conflicts, or abuse (Kozlowski et al., 2007). Falls were the primary cause of TBI in 2014. (CDC, 2019a). Fall-related injuries accounted for over half (48%) of all TBI-related emergency department visits in children ages 0 to 17. Over one-quarter (28%) of TBI-related emergency department visits in children younger than 17 years of age were caused by being struck by or against an object (CDC, 2019a). Haider et al. (2004) listed motor vehicle collisions as the number one and being hit by a motor vehicle as the number two cause for injuries in children ages 4-17.

In children, it is estimated that more than a quarter of head injuries occur during athletics. Head hits are more common in American football, ice hockey, lacrosse, and soccer, and these sports are the focus of the majority of head impact investigations (Waltzman et al., 2021). Youth tackle football players ages 6 to 14 are 15 times more likely than flag football athletes to experience head hit during a practice or game, according to a CDC study published in Sports Health and are 23 times more likely to endure a high-magnitude head impact (Waltzman et al., 2021). Nearly all athletic endeavors pose some risk of concussive injury. Among the more commonly played high school sports, football and ice hockey have the highest incidence of concussion, followed by soccer, wrestling, basketball, field hockey, baseball, softball, and volleyball (Kirkwood et al., 2006). In certain sports (e.g., football, rugby), the risk of injury depends on the position played. Higher rates of concussion are seen in games than practices, except possibly volleyball and cheerleading.

McKinlay and colleagues (2010) investigated the preinjury risk factors for pediatric TBI’s. Researchers found that high maternal punitiveness, having four or more adverse life events (e.g., change in schools, divorce of parents, death in the family), and being male were most predictive of incurring TBI (Bradley-Klug et al., 2015; McKinlay et al., 2010). Other risk
factors for suffering a concussion include a history of head injury and premorbid attention deficit hyperactivity disorder (ADHD; Bradley-Klug et al., 2015; Cook et al., 2021).

Furthermore, some students are at higher risk for sustaining a concussion than others. These include students with a history of learning disabilities, attention deficit, hyperactive disorder (ADHD), or other developmental disorders (CDC, 2015a). Once a student sustains a concussion, no matter the sport or circumstances, several factors can affect the manifestation of symptoms and the trajectory of recovery. Other risk factors for more intense symptoms or protracted recovery include students with a history of previous concussions and those who have a history of migraines or headaches (Glang et al., 2008).

Several risk variables have been identified that may influence post-concussion symptoms' occurrence, intensity, and duration. Eisenberg and colleagues (2014) reported that 77%, 32%, and 15% of children and adolescents develop concussion symptoms after one week, one month, and three months, respectively. Although the risk factors previously highlighted are not exhaustive, applying these findings in the classroom can aid in delivering a tiered return-to-learn strategy that is informed, focused, and efficient (Bradley-King et al., 2015).

**Initial Signs and Symptoms of Concussion**

Most people with a brain injury recover well from symptoms experienced at the time of the injury. Symptoms and signs usually appear immediately after an injury. However, one may not know how severe the injury is initially, and some symptoms may not show up for hours or days (CDC, 2019a). Parents or guardians can see various indicators of concussions, including an inability to recall events that occurred before or following a collision or fall; appears dizzy or confused; forgets an instruction; is unclear of the game, score, or opponent; walks clumsily;
answers questions slowly; loses consciousness; and changes in mood, behavior, or personality (CDC, 2019a).

Symptoms reported by students are organized into four categories: thinking/remembering, physical, emotional, and sleep (CDC, 2019a). Having difficulty thinking clearly, remembering, or concentrating; feeling cognitively "foggy;" feeling slowed; having difficulty concentrating; having difficulty remembering things; forgetting already learned information; experiencing confusion about recent events; answering slowly, and repeating questions are some of the signs and symptoms of thinking/remembering. Headache, nausea, vomiting, balance issues, impaired vision, exhaustion, sensitivity to light or noise, and a confused or stunned appearance are some of the physical indications and symptoms. Emotional indications and symptoms include irritability, heightened emotions, and worry. Drowsiness and changes in sleep patterns, such as trouble falling asleep, increased sleep, or decreased sleep, are examples of sleep-related signs and symptoms.

Typically, individuals recover from a concussion within two to three weeks without prolonged complications; however, in about 10 to 20 percent of cases, concussive symptoms persist for a number of weeks, months, or even years (National Research Council, 2014). Recovery may be slower in elderly persons, young children, and teenagers in general. Those who have already had a brain injury are at an increased risk of suffering another (CDC, 2019a). Some people may also find that it takes longer to recover if they have experienced a concussion before. This is especially significant because the pressures of schooling can exacerbate symptoms and negatively impact adolescents' academic achievement (Lewandowski & Rieger, 2009).
Neuropsychological Consequences of Concussion

Because the nature and length of concussion symptoms differ considerably from person to person, adolescents who incur concussions may require post-concussion accommodations as well as continued school monitoring (Davies et al., 2015). Deficits of school-aged children who sustain a TBI may include neurological consequences, including deficits in attention, memory, executive functions, social skills, emotional regulation, behavior management, and academic skills, and social and behavioral problems that can affect social relationships (Lewandowski & Rieger, 2009). A basic understanding of symptoms and how they progress will likely be beneficial to school psychologists and other school personnel since it will help guide the concussion evaluation process (Bradley-Klug et al., 2015).

Neuropsychological testing gives unique information that can be quite useful in identifying an injury and monitoring healing over time. The student's performance profile on neurocognitive measures can also help guide the management of school demands (Gioia, 2015). Specific neurocognitive domains that have demonstrated sensitivity to concussion are attention and concentration, working memory, processing speed, learning and memory, and executive functions.

In these instances, school psychologists could play a critical evaluative role. First, neuropsychological test instruments may be sensitive to some of the neurocognitive problems brought on by a concussion. Thus, school psychologists could conduct a comprehensive evaluation to delineate the effects of the concussion and then develop interventions to mitigate the effects. Standard psychoeducational testing, including IQ and achievement tests, is not likely to be sensitive to the neurocognitive difficulties of concussion. Specific tests of memory,
processing speed, attention/concentration, effort, and fluency usually will elicit the cognitive problems associated with concussion (Lewandowski & Rieger, 2009).

A multimodal assessment battery, including post-concussion symptoms and cognitive performance, has been recommended as the most effective means to evaluate concussion (Echemendia et al., 2011; McCrory et al., 2017). In a multisport neuropsychological testing program at Penn State University, Echemendia et al. (2001) followed a total of 996 athletes from football, men and women's soccer, men's ice hockey, men and women's basketball, wrestling, and women's lacrosse. Data were presented on the first 29 athletes who sustained a concussion. Memory recall, attention and concentration, problem-solving ability, visual tracking, reaction time, and information processing speed, among other cognitive functions, were examined. The results indicate that the neuropsychological test battery yielded significant differences between injured athletes and controls at 2 hours and 48 hours following injury. Notably, the injured players scored worse at 48 hours than they did at 2 hours postinjury, whereas the controls performed better at 48 hours than they did at 2 hours. On follow-up univariate analyses, control athletes performed much better on tests assessing working memory, attention and concentration, verbal learning, verbal memory, and divided attention, indicating statistically significant differences. Controls outperformed injured athletes on 20 of the 23 summary scores, despite statistically significant differences on five measures. This finding is consistent with the neurochemical cascade described earlier and suggested that neurocognitive functioning may deteriorate for some time following an injury (Echemendia et al., 2001).

Despite the frequency of concussions, surprisingly, little information is devoted to managing and rehabilitating concussions in sports. Cognitive difficulties usually include decreased information processing speed, memory and learning, and aspects of executive
functions. In addition, athletes with persistent symptoms often report depression, anxiety, reduced frustration tolerance, diminished self-esteem, and interpersonal distress. In the case of persisting cognitive difficulties, a plan that includes cognitive rehabilitation (memory training, organizational skills, attentional skills) may be warranted. The emotional and psychosocial aspects of concussion are also significant (Echemendia et al., 2011).

Overall, concussion-related disability can significantly influence a student's ability to operate (Parsons et al., 2013; Vaughan et al., 2013). In order to best assist a student's total rehabilitation (e.g., thinking/remembering, physical, emotional, sleep) and successful return to the learning environment, a multidisciplinary approach is required (Bradley-Klug et al., 2015).

**Educational Outcomes**

Following a concussion, it's not uncommon for children and teenagers to have difficulty at school (Halsted et al., 2013). Many aspects of a concussion can affect a student in the classroom. Similar to recovering from other physical injuries, students recovering from a concussion may need to rest. For their brains to heal, they need cognitive rest. This includes giving a brain a break from activities that have a lot of concentration. Rest is intended to limit a student's activities to a level that is bearable and does not exacerbate or result in the reemergence of concussion symptoms following a concussion (CDC, 2019a). The school setting is often not conducive to cognitive rest, a standard treatment recommendation, and concussion recovery due to ongoing cognitive demands and exposure to certain environments that may exacerbate concussion symptoms in certain patients. Deficits for school children with a concussion may involve neuropsychological repercussions, including executive functioning deficits, academic deficits, and social and behavioral difficulties that might interfere with social connections (Jantz & Coulter, 2007). In the classroom, cognitive issues such as learning new activities or recalling
previously learned material can be problematic (Halsted et al., 2013). In school, it makes little difference if a child has one, two, or three symptoms.

Multiple concussion symptoms (e.g., headaches, sensitivity to light and noise, fatigue, and difficulty concentrating or remembering) directly impact a student's ability to succeed academically (McCrory et al., 2017). Emotional symptoms of a concussion can manifest as irritability, anxiety, and sadness (Davies et al., 2015). Exposure to bright lights and electronics, as well as noisy cafeterias and halls, may exacerbate symptoms at school (Halsted et al., 2013). Any symptom necessitates a response, which is why a conservative approach is appropriate in an academic atmosphere (Parsons et al., 2013; Vaughan et al., 2013). Individually-tailored modifications can reduce cognitive exertion to school attendance and workload and other accommodations such as permitting students to take breaks during classes. Unfortunately, because most children and adolescents appear physically normal following a concussion, school administrators frequently overlook the need for academic or environmental accommodations (Halsted et al., 2013). School-aged children seldom report concussive symptoms, which makes the diagnosis a challenge.

One of the primary deficits of a concussed student is diminished academic performance. Ransom and colleagues (2013) looked at the link between learning and concussion recovery in children in elementary (n=17), middle (n=74), and high school (n=124). They discovered that both the number of symptoms reported and the severity of those symptoms were linked to learning difficulties (e.g., problem studying for tests, paying attention, completing homework). The authors also found that students experienced increased symptoms when asked to engage in activities that required cognitive effort (Ransom et al., 2013). Students frequently require academic adjustments and sometimes even temporary special education services. Many
symptoms, such as difficulties paying attention to directions or instruction, and linked physical illnesses such as nausea or weariness, can impact academic performance. Regrettably, academic difficulties related to concussions are frequently misdiagnosed as normal academic underperformance and are not investigated further. This error may result in the child not receiving assistance, which is the true cause of the impairments (Jantz & Coulter, 2007).

**School-Based Concussion Management**

The management of concussions has changed significantly over the last several years. Students who have sustained a concussion and have moved into the recovery process can participate in academic activities, but appropriate adjustments or accommodations are in place (Dettmer et al., 2014). Once symptoms have resolved, a gradual return to learning protocol can be undertaken. After recovery, it is recommended that a student return to learning progress in an incremental, stepwise fashion while being monitored by school personnel. When students prematurely return-to-play (RTP) or return-to-learning (RTL), students may experience prolonged recovery of concussion symptoms, including impairments in working memory, motor skills, language, verbal fluency, concept formation, and general cognition and behavior (Arroyos-Jurado et al., 2000). As a result, school officials want recommendations on how to appropriately reintroduce individuals to the classroom environment and administer measured amounts of cognitive exertion without causing symptoms to worsen. (Davies, 2016).

A school that implements concussion policies and procedures before a student has an injury will be better equipped to handle a successful comeback. The following sections will detail the main components of a school-based concussion treatment strategy and who should be involved in inappropriate interventions. While there is no one-size-fits-all solution, some symptoms and neuropsychological manifestations signal the need for accommodations (Sady et
al., 2011). School personnel should watch for increased problems paying attention or concentrating, longer time needed to complete tasks or assignments, increased symptoms, increased problems remembering or learning new information, less tolerance for stressors, difficulty managing and completing complex assignments (Gioia, 2015). To combat this and aid in the student's recovery following a concussion, temporary academic support strategies or the incorporation of RTL policies are imperative (Halstead et al., 2013; Lyons et al., 2017; McGrath, 2010; Davies, 2016). Parents, medical personnel, and educators can work together with the student to evaluate the intensity of symptoms in order to make its decision (Davies, 2016). Proper assessment and management of a concussion are crucial because repeat concussions can result in decreased neurocognitive functioning, increased symptomatology, and, at times, catastrophic outcomes.

**Return to Learn Overview**

Return-to-learn is the process of transitioning back to the classroom following concussion, and complete or full RTL refers to the complete reintegration of a concussed student back into the classroom without academic accommodations that were not provided prior to injury (Sady et al., 2011). Despite the fact that no single protocol has been agreed upon, specialists have presented concussion management approaches that share a number of characteristics (Bradley-Klug et al., 2015; McAvoy, 2012; Sady et al., 2011). In general, a return-to-learn protocol should consist of assessment, intervention, progress monitoring, and intervention adjustment based on the individual’s needs (McAvoy, 2012).

In the United States, it is estimated that between 47% and 70% of school districts lack formal guidelines to properly assist concussed students during the RTL process (Kasamatsu et al., 2016; O’Neill et al., 2017). Concussion awareness, education, and management programs are
determinedly needed in schools across the country (Sady et al., 2011). While several states have passed legislation and implemented policies regarding education management of athletic RTP for concussed student-athletes, less attention has been given to formal policies and procedures that support the recovery of the student RTL (Sady et al., 2011; O’Neill et al., 2017).

To understand the magnitude of this need, Sady and colleagues surveyed parents of students with concussions ($n=49$) to ask about their child’s return to school following injury. Results showed only 24% reported that they were aware of a written plan for concussion management at their child’s school. In addition, the majority of parents polled (70%) said their child needed some type of support when they returned to school, with rest breaks and extra time for homework and examinations being the most generally recommended accommodations (Sady et al., 2011).

A recent study found only about half of individuals who sustained concussions received information on returning to play and rarely received information regarding return to school (Arbogast et al., 2013). Thus, there may be a widespread lack of understanding relating to how a concussion can affect one's academic performance. Due to a wide array of variables influencing concussions, many facets of treatment must be utilized to understand the management of a concussion's severity and susceptibility. Several models describe a process of concussion management within a team framework.

Changes in concussion diagnosis guidelines continue to occur, making it difficult for schools to actively assist with the diagnosis and recovery process. Overall, when considering best practices for concussion management, there is a consensus that physical and cognitive rest are indicated for a student's recovery from a concussion (Graham et al., 2014; McCrory et al., 2017). It is essential for educators to monitor a concussed student's post-injury workload and set
boundaries if they are overdoing it. Parents, medical personnel, and educators should work together with the student to evaluate the severity of symptoms in order to make decisions about returning to school (Davies, 2016).

**School-Based Concussion Team Model**

Unfortunately, school professionals frequently lack proper understanding and training on concussions and frequently fail to identify and comprehend the requirements of students who have sustained one (Davies, 2016). There is a need for ongoing concussion prevention and education protocols in schools. The development of a comprehensive school-based concussion management program is in its infancy. Only a few established protocols are known to be used, including BrainSTEPS, Heads Up to Schools from CDC (2015), and Nationwide Children’s Hospital Concussion Clinic.

The first stage in school-based concussion education and management is to create policies and procedures that will aid returning students in their recovery. Before the start of the school year, an action plan based on the policies and procedures must be in place to ensure that concussions are identified early and managed efficiently. Identifying key employees and their roles in supporting the student's return is an essential component of the plan to help kids ease back into school life (Sady et al., 2011). Many stakeholders are likely to be involved due to the effects a concussion has on students' social, physical, behavioral, and emotional functioning (Bradley-Klug et al., 2015). The first and least restrictive avenue for delivering services to a concussed student would be to assemble the school-based intervention team. This avenue assumes the same model as that used for children who are struggling with academic-related problems, including, for example, aggressive behaviors and learning difficulties (Chesire et al., 2015).
The presence of a collaborative team can facilitate coordinated, medically approved, return-to-activity decisions. School-based personnel can collaborate with the family to develop an appropriate program that will meet the student’s needs (Davies, 2016). In order to make the formation of the concussion team easier, the positions should be assigned based on the current competencies and responsibilities of the participating experts, rather than expecting them to learn an entirely new skill set. Concussion team members' duties should be aligned with appropriate concussion-specific skills so that team members can effectively assist kids who are recovering from a concussion (Davies et al., 2016). A school team of parents, school psychologists, teachers, nurses, administrators (and, if appropriate, a coach or athletic trainer) might need to be set up to support the students when they return to school (Davies et al., 2015).

Table 1

*Concussion team process adapted from Nationwide Children's Hospital (2012)*

<table>
<thead>
<tr>
<th>Step One</th>
<th>a. School community informed about the reporting process.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>b. Concussion reported to concussion team leader.</td>
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<tr>
<td>Step Two</td>
<td>a. Contact student and family</td>
</tr>
<tr>
<td></td>
<td>b. Meet with the student upon returning to school</td>
</tr>
<tr>
<td>Step Three</td>
<td>a. Assess medical needs</td>
</tr>
<tr>
<td></td>
<td>b. Use medical documentation if available.</td>
</tr>
<tr>
<td>Step Four</td>
<td>a. Assess academic needs and create adjustments</td>
</tr>
<tr>
<td></td>
<td>b. Use recommendations from a healthcare provider if available</td>
</tr>
<tr>
<td>Step Five</td>
<td>a. Distribute adjustments to teachers</td>
</tr>
<tr>
<td></td>
<td>b. Contact family and athletic staff with relevant updates</td>
</tr>
<tr>
<td>Step Six</td>
<td>a. Determine to re-assess medical and academic needs based on feedback from team members</td>
</tr>
</tbody>
</table>
There are several models that describe a process of concussion management within a team framework. Davies (2016) describes the concussion management process developed by Nationwide Children's Hospital's Concussion Toolkit that can be individualized to meet school and district needs (see Table 1). The first step is to inform the school community that there is a specific process for each school. Once a case has been confirmed, the team meets with the students and their families to gather information and ensure good communication. The third step involves gathering documentation, if available, from a physician. This documentation should include restrictions from cognitive and physical activity as well as recommended adjustments to the learning environment. The fourth step involves the school team assessing the concussed students' academic needs. The team can then develop an extensive and individualized academic accommodation plan to be distributed to the students' teachers. Following that, the plan for adjusting the learning environment and academic expectations are distributed to the student's teachers and family. Once a student returns to school, the team will begin implementing any of the necessary academic adjustments. The final step includes the team determining an appropriate timeline for a reassessment of needs to ensure that the adjustments are not maintained for an unnecessary time. At this time, the team also determines if new adjustments may be required to address symptoms or issues. Once the reassessment is complete, the team can determine if any adjustments are needed or determine an appropriate timeframe to discontinue services (Davies, 2016).

Another model, called BrainSTEPS, was created by the Brain Injury Association of Pennsylvania Inc., the Pennsylvania Department of Education, and the Pennsylvania Department of Health in 2007. BrainSTEPS was created to work with school teams and families collaboratively in order to develop and provide educational programs to students who have
suffered from any type of acquired brain impairment. BrainSTEPS (Strategies Teaching Educators, Parents, and Students) is a novel collaboration between state agencies and local school districts that aims to improve children and adolescents' educational results. BrainSTEPS consulting teams are made up of individuals from a range of professions who have received extensive training on how to educate pupils who have sustained a traumatic brain injury. These specialists serve as area consultants, providing educators and families with resources and training. They train district-level return-to-school concussion management teams to monitor student symptoms at the district level throughout the early recovery phase. For students who continue to have symptoms after four weeks are sent to their BrainSTEPS team for additional assistance. In such circumstances, the team serves as a resource to consult with the concussed student's educators and family and follow the student annually until graduation. Myers and colleagues (2018) offer insight into the implementation and feasibility of BrainSTEPS services. The study indicated the BrainSTEPS team members spent a majority of their time (23.8%) providing consultative activities, including modifying the classroom setting, instructional technique, curriculum content, implementing behavioral tactics and utilizing assistive technology, and demonstrating interventions school personnel (Myers et al., 2018). This is an excellent example of a strong model for brain injury consulting, but it requires state-level support and funding.

As the child's concussion symptoms improve, the school academic team and family team should feel comfortable increasing mental and social activities, as tolerated by the student, and incorporating the medical team only as needed in school planning, with the exception of pre-planned follow-up visits (Halsted et al., 2013). Some students take less than a week to recover, most take one to three weeks to recover, and some can take months or years (Barlow et al.,
Since the rate of recovery can vary a great deal from student to student, plans for returning students to the classroom and extracurricular activities must be individualized. Some students may progress through the return to learning stages quickly. In contrast, others may only be able to tolerate a few minutes of cognitive activity in the days following the injury. All schools must understand the need for team management for a student recovering from a concussion and guarantee that all children recovering from a concussion have a designated staff member who will be responsible for a seamless return to school (Halsted et al., 2013). Thus, it is essential for school teams to conduct ongoing symptom monitoring and include input from the student (Davis, 2016).

Integration of Concussion Team Processes within MTSS Systems

Suppose a school team has information about a medical condition that will affect a student's ability to perform academically, socially, or behaviorally. In that case, it is the school's responsibility to intervene to assist the student during recovery (Halstead et al., 2013). A multi-tiered system of support (MTSS) is a framework that many schools use for awareness, early identification, and early intervention for students struggling with academic or behavioral needs (Orla & Rinaldi, 2013). An MTSS approach is a collaborative, problem-solving approach amongst school personnel, the student, and parents that collectively assess the student's needs, design the necessary interventions, continuously monitor the student's progress, and adjust the interventions accordingly to meet the student's needs (Bradley-Klung et al., 2015; Sady et al., 2011; Gioia, 2015). MTSS allows for a multi-step, targeted approach that school professionals can use to monitor students' progress by increasing intervention levels. At each intervention level, the team assesses the student to determine whether additional instruction or support is
needed. MTSS uses three tiers of support to help schools organize levels of support based on intensity to receive necessary instruction, support, and interventions based on need.

Academic adjustment, academic accommodation (Section 504), and academic modification are suggested by Halstead et al. (2013) as a reasonable three-tiered strategy for the delivery of assistance for students who have incurred a concussion (IDEA). The academic adjustment layer in this strategy begins during the first 1–3 weeks after a concussion and provides informal basic support to the learner through academic environmental accommodations that do not necessitate modifications in standardized testing or curriculum (Jantz, 2015).

Tier I, or universal supports, typically refers to services available to all students and includes both prevention and early intervention. (e.g., school-wide programs, core curriculum). Tier II provides supplemental instruction to those students who display inadequate response to the core instruction in Tier I and require a more in-depth problem-solving process (e.g., small group counseling, tutoring, targeted behavioral skills training). Despite efforts at Tier I and Tier II levels to promote student recovery, a small proportion of kids may need extended and possibly permanent curricular changes, which may require further testing and documentation through an Individualized Education Plan or Section 504 plan (Bradley-Klug et al., 2015; Halstead et al., 2013). When concussion symptoms last longer than three weeks, the academic accommodation layer kicks in, including accommodations for standardized testing, extra time for classwork and assignments, and class schedule changes (Jantz, 2014). Tier III refers to more intensive services for individuals or small groups and is usually limited to less than 10% of students (e.g., individualized instruction, intensive therapy; NASP, 2020). Special education may or may not be included in Tier III services. A systematic problem-solving approach and an integrated data
collection system based on the MTSS approach are employed at each layer of the model (Orla & Rinaldi, 2013).

Regardless of the size or demographics, any community/school can create a multidisciplinary concussion team. The main focus of all school districts creating a concussion management protocol is communication and collaboration. School teams should develop a protocol that allows for support to be implemented immediately upon the student's return to school, ensure the student receives consistent messages from school professionals, and data are collected to determine how to best support the student as well as to track the recovery process (Halsted et al., 2013). Davies (2016) indicates if a student's concussion symptoms persist, academic accommodations and student support may be provided through MTSS, a formalized health plan, or through provided options under federal law: Section 504 plan or an Individualized Education Program (IEP). To effectively give services to students who have received a concussion, researchers advocate a tiered structure that uses established return-to-learn standards (Bradley-Klug et al., 2015; Davies, 2016; Sady et al., 2011).

**Tier I.** Tier I preventative measures include having a protocol in place to outline policy procedures such as reporting and responding to a concussion, helmet and seatbelt education, as well as concussion education to all school personnel, coaches, athletes, and parents (Bradley-Klug et al., 2015; Davies, 2016). Despite prevention education and preventive measures, there will be students who sustain a concussion. Schools need to be prepared and equipped with the right tools to immediately implement concussion management procedures. School policies should clearly state how school employees will be informed of a returning student's injuries and specific symptoms and how they may help with the student's transition and adjustments (Sady et
School psychologists possess specific skills to initiate these early intervention procedures conducting a concussion evaluation.

In addition, the school psychologist should give the student and their family instructional documentation explaining the symptoms, recovery period, and coping methods associated with a concussion (Bradley-Klug et al., 2015). Ponsford and colleagues (2001) used a Tier 1 intervention with 130 concussed children aged 6–15. The children were randomly allocated to one of two groups: an intervention group in which they got an informational booklet including the previously specified information, or a control group, in which they received no information. Compared to children in the control group, parents of children who got the educational booklet reported significantly fewer post-concussion symptoms and behavioral changes in their kid three months after the injury. Furthermore, distributing an instructional pamphlet to children who have suffered a concussion is a simple, low-cost method that can be implemented at the universal or Tier 1 level.

Researchers have determined that 80% to 90% of concussions resolve in 3 to 4 weeks (CDC, 2015a; Collins et al., 2006). A well-coordinated system of cognitive reduction, physical rest, and academic adaptations in the general education classroom will benefit the majority of students who have suffered a concussion. Additional Tier II assessment and intervention approaches should be in place for children whose symptoms have not entirely resolved after implementing the return-to-learn strategy (Bradley-Klug et al., 2015).

**Tier II.** The school psychologist will most likely understand the reason for the referral at this phase in the concussion care process: new symptoms have emerged, or the student has not fully recovered using Tier I methods (Bradley-Klug et al., 2015). The first step of the standard return-to-learn strategy begins with a period of cognitive rest for the child (Arbogast et al., 2013;
Bradley-Klug et al., 2015; Brown et al., 2014; Sady et al., 2011). Brown and colleagues (2014) asked 335 kids aged 8–23 years who had a concussion at Boston Children's Hospital to fill out questionnaires concerning their symptoms and cognitive activity at each visit. The cognitive activity questionnaire had a scale of 0 to 4 (total cognitive rest to full cognitive activity), with examples of activities to correspond to each number. Patients who reported the most cognitive activity took longer to recover than those who reported the least amount of cognitive activity, which highlights the need for cognitive rest (Brown et al., 2014). Another recent study showed that more than 80% of students 6 to 18 years old with concussion had an increase in symptom severity during school during the first two weeks following injury (Gioia et al., 2010). Another study demonstrated that one week of complete cognitive rest results in decreased symptoms and improved cognitive performance (Moser et al., 2012).

The next step of the return-to-learn protocol recommends that the student returns to school for a partial day (Bradley-Klung et al., 2015). This stage should be taken once the student has recovered enough to focus on academics for 30 minutes (McAvoy, 2012) to 1–2 hours (Arbogast et al., 2013), as shown by the student's readiness to do some light reading or watch television. When the student is able to return to school for a half-day, a progression from a full day with maximal supports to moderate then minimal, and finally no supports should be followed, with each reduction in supports marking a separate phase (Arbogast et al., 2013; Bradley-Klung et al., 2015). Reasonable Tier II RTL adjustments include modified schedules, modified assignments, transportation to and from school, no physical activity, alternate periods of mental rest with mental exertion, prioritizing work, and avoiding noisy and overstimulating environments (Davies, 2016). They are non-formalized adjustments and do not require changes to the curriculum (Halstead et al., 2013). It is suggested that the multidisciplinary concussion
team engaged at Tier II continue to both collect data and progress monitor symptoms, and communicate and collaborate with medical professionals and parents to promote further recovery (Bradley-Klug et al., 2015; Davies, 2016).

Approximately 10% to 20% of students who have sustained concussions may have symptoms that extend beyond 3 or 4 weeks (Collins et al., 2006). While these numbers are low, a small but significant percentage of students with a concussion suffer severe and long-term neurocognitive and physical effects. Students resistant to Tiers I or II management attempts may need the most intensive level of assessment and intervention provided at Tier III (Halsted et al., 2013).

**Tier III.** For students with symptoms lasting longer than three weeks, more medical management concerns and accommodations, rather than academic adaptations, may be required (Halsted et al., 2013). To satisfy the needs of students in this tier, a multidisciplinary team meeting with the student's caregivers and medical specialists is recommended in order to build a well-documented educational plan. Interventions aimed at academic, behavioral, emotional, and physical improvement and performance may be included in this educational plan (Bradley-Klug et al., 2015).

In K-12 settings, the Individuals with Disabilities Education Improvement Act (IDEA 2004) and Section 504 of the Rehabilitation Act (1973) mandate accommodations for students with disabilities. Section 504 plans can be temporary or permanent. Temporary Section 504 plans are written for those medical conditions that are expected to be six months or less. For most concussion cases, the temporary Section 504 plan appears an appropriate course of action (Davies, 2016; Halsted et al., 2013).
If a school team has information of a medical condition that will affect a student’s ability to perform at school academically, socially, or behaviorally, it is the school’s responsibility to intervene to assist the student during recovery. For this to happen, the school professionals who work with the student must understand how a concussion impacts learning and how to appropriately support the student (Halstead et al., 2013). In order to effectively support students, it is recommended that schools have policies and procedures in place to manage the needs of these students. The protocols should target the student’s symptoms as the focus of intervention, linking specific accommodations in efforts to limit symptom expression (Chesire et al., 2015; Lumba-Brown et al., 2018). For these rare concussion cases, if a disability may be identified that requires significant academic adjustments for a prolonged period, the school might consider formalizing adjustments into a section 504 plan (Davies, 2016).

**School Psychologist Knowledge of Concussions**

Because concussion management is complex, a multidisciplinary team approach with a varied group of people with different skills and backgrounds is required (Davies et al., 2016). School psychologists are particularly qualified to deliver a wide range of services that enable schools to create complete student support systems, improve school and district effectiveness, and support improved student outcomes (NASP, 2020). By applying the tiered problem-solving approach to address presenting difficulties and implement effective solutions, the school psychologist can play a vital role in assisting the student (Bradley-Klug et al., 2015). Assessment of academic and behavioral needs, development of accommodations, monitoring the progress of interventions, leading a school-based team, and consulting with families and medical professionals are all part of a school psychologist’s repertoire of skills (Davies, 2015). In addition, a school psychologist with experience in assessment, progress monitoring,
accommodation and intervention, and consultation may be the best option to lead the concussion team in assisting students in returning to school effectively (Davies et al., 2016; Eftaxas & Canto, 2020). In traditional roles, school psychologists demonstrate these skills on a daily basis, suggesting they are among the most qualified of school personnel to aid students’ recovery. With their expertise in behavioral modification, learning theory, and biological influences on behavior and learning, school psychologists are in a position to provide collaborative services to teachers, information services to all school professionals, and direct student support for students who are struggling to succeed in the classroom, as well as providing community outreach to educate families, the community at large, and medical professionals (Chesire et al., 2015).

However, research indicates that school psychologists and other school personnel endorse a limited knowledge base regarding the way in which to work with these students (Canto et al., 2014). Conversely, researchers have found that although school psychologists learn information about concussions and mTBIs in graduate school, many lack the requisite knowledge and skills to adequately meet this population of students (Davies, 2013). Surveys completed by school psychologists and other school personnel often reveal a limited knowledge base regarding how to work with these injured students (Canto et al., 2014).

In a study conducted by Canto et al. (2014), researchers found that only 66% of school psychologists surveyed reported that they had received training for TBI in graduate school or professional development activities, but only 12% reported that they were very comfortable working with these students. Indeed, 39% of school psychologists reported feeling uncomfortable or uncomfortable working with concussed students, indicating little evidence to support that school psychologists are comfortable in this role and working with this population (Canto et al., 2014). This information was corroborated with data from Hooper (2006) that
indicated 83% of school psychologists reported needing more training for working with children in post-TBI.

Comparably Glang and colleagues (2018) studied both perceptions and knowledge of TBI's in a sample of 232 school psychologists. Previously used instruments, TBI Knowledge Survey, and Perceptions of abilities, were modified and used to investigate. Their results indicated the mean score of TBI knowledge is low (62.7%; Glang et al., 2018). Additionally, school psychologists said they were most qualified to work as a multidisciplinary team member serving a student with TBI and least competent to serve as an IEP manager for a kid with TBI. Similar to Davies et al. (2013), school psychologists with more experience working with students with TBI rated themselves significantly higher on the same scale (Glang et al., 2018). Overall these findings are consistent with Hooper (2006), indicating that little has changed regarding TBI knowledge and awareness among these essential school personnel over time.

Germane to the above studies, Eftaxas and Canto (2020) assessed school psychologists' knowledge of TBIs and their willingness to work with students who are reintegrating into school after sustaining a TBI, and their perceptions of the most qualified school personnel to be the concussion team leader. Knowledge alone was not a significant predictor of willingness to be the CTL. Many of the studies referenced above suggest the school psychologist is the best trained school personnel to work with students affected by TBI's, where the present study showed 34% of school psychologists perceive to be the most qualified. The majority of school psychologists endorsed the school nurse (51%) to be the most suitable to aid students returning to school. Interestingly, the school psychologists were also asked what role they most prefer on a concussion team, and 72% indicated they feel comfortable being on the team but not the leader (Eftaxas & Canto, 2020). Concerning training in the Eftaxas and Canto (2020) study, 50% of
participants did not feel confident in the amount of training they received regarding TBIs. When asked where they received most of their training on TBI, the majority responded "from their research," thus conferences and workshops for school psychologists surrounding topics of TBI management and return-to-learn protocols may be necessary (Eftaxas & Canto, 2020).

This study seeks to replicate these findings. This study will also use school psychologist concussion knowledge to understand which school psychologists perceive they are competent to engage in each step of Davies' (2016) model. This is an area of need—and opportunity—for school psychologists. This research study aims to promote public awareness, knowledge, access to resources, and research on concussions. Thus, the purpose of this study is to enhance awareness of return-to-learning protocols and to better understand the school psychologist's role in concussion management and reintegration.

Summary

Despite medical improvements and recent changes in pediatric mild traumatic brain injury (mTBI), cognitive and educational rehabilitation for mTBI youth is still in its infancy (Kontos, 2017). As neuroscience, psychology, and education research advances, the science of identifying and treating traumatic brain injuries in children will continue to grow, necessitating the development of more uniform guidelines and rules to guide training and practice. Proper acknowledgment may improve the treatment of students with mTBI/concussion by fostering cognitive, academic, and psychosocial rehabilitation in schools. It is evident that school psychologists have crucial training capacities that can have a significant impact on the reorientation of services for children and families in ongoing recovery from mTBI.
CHAPTER III: METHOD

Introduction

For many years, school psychologists' lack of TBI knowledge and training has been acknowledged as a vital area for development, but little effort has been done to correct the condition (Davies et al., 2013). A significant proportion of youth with concussions go unreported due to the lack of effective concussion procedures. The purpose of this study is to examine school psychologists' knowledge regarding concussions and to consider the role of school psychologists in assessing, monitoring, and treating students with a concussion.

This chapter describes the theoretical framework, methodology, and methods utilized to examine school psychologists' concussion management knowledge, current engagement, perceived competence, and factors leading to competency. This research study includes a questionnaire that assesses school psychologists' knowledge of symptoms and outcomes of concussions and current practices regarding return-to-learn protocols following concussion injuries. Current practicing school psychologists were asked about their experiences working with students who had suffered a concussion. The questionnaire, which will be described in a subsequent section, was tailored to the population targeted for the study. Findings from both descriptive and predictive questions may inform both the design and implementation of school-based concussion management programming. This section outlines the participants, measures, and addresses the rationale of the knowledge questionnaire. Finally, data collection and analysis

Research Questions and Hypotheses

This exploratory study aimed to investigate school psychologists' knowledge and perceived competence regarding concussions, as well as quantify their competence to engage in a school-
based concussion management paradigm among a national sample of school psychologists employed in public schools. The study examined the following research questions:

1. What is the current state of school psychologists’ knowledgeable of pediatric concussion/mTBI symptoms and outcomes?

2. Where (i.e., graduate coursework, supervised clinical experience, previous work experience, formal professional development, independent professional development) do school psychologists acquire concussion/mTBI knowledge?

3. How do school psychologists rate their competence to engage in each step of a school-based concussion/mTBI management model?

4. What factors (i.e., concussion/mTBI knowledge score, highest degree, graduate coursework, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development) predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model?

5. Do school psychologists report having been involved in each step of a school-based concussion management model?

The researcher hypothesized that knowledge of TBI’s and previous experience will be positively related to perceived competence to engage in each step of concussion management protocols. Additionally, it was hypothesized the factors of concussion/mTBI knowledge score, highest degree, graduate coursework, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development are significant predictors of school psychologists’ perceived competence to engage in each step of a school-based concussion management model. It was also hypothesized that
there is a statistically significant difference between the total knowledge questionnaire score between doctoral and nondoctoral level psychologist.

**Research Methodology**

The purpose of this exploratory study was to identify and describe the competencies, training, and experiences of school psychologists and to quantify their knowledge of concussions, involvement in current concussion management procedures, and number of students with concussions served. Findings from both descriptive and predictive questions may inform both the design and implementation of school-based concussion management programming. Quantitative methods were used to answer research questions regarding the relationships between knowledge and competence engaging in procedures, and school psychologist’s implementation characteristics (i.e., degree, training, career experience). In prior studies, a quantitative approach was used to differentiate the relationship between knowledge of TBI and return-to-learn protocols and the respondent’s willingness to be the concussion team leader (Eftaxas & Canto, 2020).

Several studies used self-rated confidence in knowledge, training, or competence as a single item or question following TBI training and in-service (e.g., Canto et al., 2014; Davies & Ray, 2014; Hooper, 2006). Similarly, self-reported confidence is rated using a single question to examine overall knowledge and training. Additionally, this research study includes a questionnaire that aims to assess school psychologists’ knowledge of concussions and current practices regarding return-to-learn protocols following concussion injuries. The survey was created through the Qualtrics XM software and distributed to potential school psychologists through email. The questionnaire was compiled from a questionnaire used in previous research,

**Research Design**

The current survey research methodology was designed to investigate whether school psychologists are competent to assist students with concussions in returning and succeeding in the classroom setting. Additionally, the survey was developed to provide an examination of school psychologists’ knowledge in concussion identification and response, the ability to apply skills in relation to concussion recognition and response, and implementation factors as they relate to concussion management. By understanding these factors, schools can work with their school psychologists to develop well-organized concussion management protocols to ensure optimal recovery for students with a concussion.

**Variable Definitions**

Within this study, there were multiple variables of interest. The true or false responses, together with the ratings, were used to derive support for what factors indicate school psychologists’ perceived concussion symptom knowledge and competence. The researcher operationalized the following eight different predictors calculated by a criterion variable for use in the survey. Concussion symptom knowledge was measured by participant’s responses on the TBI Knowledge Questionnaire. Participants responded that a given item is true, false, or doesn’t know. Knowledge scores were computed by counting the number of correct responses to the 21 knowledge items in which a higher score reflects greater correct understanding. The highest degree earned is defined by participant response on one question included in the demographics section. The years of experience are defined by one question in the demographics regarding their number of years as a practicing school psychologist. To predict what factors impact concussion
knowledge, school psychologists were asked to select all the sources where they acquired knowledge of TBI and return-to-learn protocols. The true or false responses, together with the ratings, were used to compare their acquired knowledge responses to determine knowledge gaps.

The final construct investigated school psychologists’ level of engagement regarding their specific role in supporting students who return to school following a concussion. The researcher measured the school psychologist’s role in a concussion management protocol by asking participants to indicate either a yes or no regarding their level of engagement in each of the seven steps of a concussion management protocol. For scoring, the sum of the number of items selected.

**Population and Sample Selection**

Participants included currently practicing school psychologist in the educational setting in the United States (U.S.). Participants were recruited by randomly selecting one state within each geographical region. The sample was selected to reflect the school districts listed in the 2020–2021 public database of school districts on the National Center for Educational Statistics website. From this database, at least ten public school districts in each geographic region of the United States was randomly chosen by using a random number generator. Following the selection of districts, the emails of the school psychologists from those school systems was obtained by researching the publicly available information from the respective school district website. Participants were not excluded based on race, ethnicity, gender, or socioeconomic status. Inclusionary criteria for school psychologists included current practicing school psychologist. School psychologists from 41 different states participated.

Out of the 1,519 emails that were invited to participate, about 14% (n=207) chose to participate in the survey. Of the 207, less than 11% (n=22) school psychologists chose not to
answer questions beyond the demographics and thus were not considered in data analysis. There were an additional 6 participants who chose not to complete the knowledge questionnaire and were excluded from the data. After these exclusions, 86.5% of initial participants completed the survey fully and were used in data analysis (n=179).

A request for IRB approval was submitted prior to data collection. After approval was obtained, the researcher began researching school districts and obtaining email addresses. The online survey was distributed via email using Qualtrics Survey Software, a website that allows surveys to be administered online and completed anonymously. Collected data was uploaded into the SPSS software program for further data analysis. Data management was completed via SPSS and will be stored using encryption and password protected hardware to be held for three years. After three years, electronic data will be destroyed by deletion. This study did not create any hard copies (paper-based data).

**Measures**

This research study includes a questionnaire that aims to assess school psychologists’ knowledge of symptoms and outcomes of concussions and current practices regarding return-to-learn protocols following concussion injuries. The questionnaire was created from previously mentioned surveys and transferred to an online survey instrument prior to the email distribution. The survey first contained an electronic consent form as required by the IRB. An introductory statement about the purposes of the research and informed consent about research participation was provided. Consent was considered to have been granted if participants choose to proceed to complete the survey questionnaire. Initial questions included screening criteria for inclusion. For example, school psychologists were asked if they were practicing school psychologists in the U.S.; only participants indicating “yes” were able to continue through the remaining questions in
the survey. The cross-sectional data allowed for a sample of only practicing school psychologists currently employed in schools. Next, the survey instrument was presented, which was created by the researcher.

Information on current practices and knowledge of concussion management and competence was obtained through a survey including several multiple-choice and Likert-scale questions. Five core areas were addressed: (1) demographics and relevant background information; (2) TBI/concussion knowledge questionnaire (3) training regarding concussion management; (4) perceived competence to engage in steps of the concussion management model; and (5) current practices. The full survey can be found in Appendix A. The anonymous survey results was in the Qualtrics database.

**Demographics and Relevant Background Information**

Participants were asked ten questions about demographic information, including gender, age, ethnicity, community setting, highest degree earned, practice credentials, years as a practicing SP, and number of students with TBI they had worked with in a school setting (Section 1 of Appendix A). In addition, participants were asked to self-evaluate their concussion knowledge and concussion recognition knowledge. School psychologists were asked to rate themselves on a Likert scale with 10 points ranging from novice to expert. Additional background questions were asked to collect information on past training obtained (i.e., formal and informal training in concussion management, etc.).

**TBI Knowledge Questionnaire**

The TBI Knowledge Questionnaire section contained 21 true/don’t know/false questions to gather information on participants’ understanding of concussions (Section 2 of Appendix A). The questionnaire used in this study was a replica of an unpublished questionnaires obtained
from respected colleagues in the field: TBI Knowledge (Eftaxas & Canto, 2020). Questions pertained to physiology, symptom presentation, diagnosis, and concussion effects on children. Each knowledge item was awarded one point for a correct response (correct = 1 point) and zero points for an incorrect response (incorrect = 0 points). Points were summed for each participant to produce a Total Concussion Knowledge score. Overall, a higher knowledge score reflected higher knowledge accuracy.

**Training Regarding Concussion Management**

The researcher measured where school psychologists are receiving their concussion management training by asking participants to indicate either a yes or no on a five different items (Section 3 of Appendix A). For example, one item asked participants to indicate either yes or no if they have acquired knowledge regarding TBI and return-to-learn protocols during “Supervised clinical experiences (e.g., practicum, internship, post-doc).”

**Competence to Engage in Specific Return to Learn Steps**

To measure SPs’ perceptions of engaging in a particular step of the return to learn protocol developed by Davies, 2015, they were asked to respond to seven Likert scale questions (i.e., “no competence,” “some competence,” “minimal standard of competence,” “advanced competence,” “exceptional competence”) pertaining to their level of competence (Section 4 of Appendix A). This survey is unique to the current study, as no prior surveys regarding perceptions of concussion management explicitly targeted areas of prevention, assessment, intervention, progress monitoring, and consultation/collaboration.

**Current Practices**

In order to assess SPs' present involvement in each step of the return to learn protocol proposed by Davies, 2015, participants were asked to indicate either yes or no on seven different
items addressing whether they engaged in the activity as a school psychologist (Section 5 of Appendix A).

**Data Collection**

The institutional review board at Duquesne University reviewed and approved this study for human subject participation before data collection began. Identified subjects were invited via email to participate in a web-based survey administered between November 2021 and June 2022. The online survey was distributed via an email link using Qualtrics Survey Software and took approximately 10-12 minutes to complete. The survey was designed in Qualtrics XM, an established research software that functions through the internet. Qualtrics is a collaborative platform that allows for survey design and dissemination. This platform was chosen due to the assurance of participant confidentiality, which helps to meet that criterion of the protection of human subjects. Upon accessing the survey via Qualtrics, participants were first presented with a brief introductory letter describing the objectives and goals of the study. A statement regarding informed consent was presented first, and all participants had the option to exit the survey at any time. Participants were then asked if they were practicing school psychologists in the United States, as this was an inclusion criterion for the study. The e-mail also provided contact information for the primary investigator and project advisor for comments, questions, or concerns about the research study or the survey instrument. The cross-sectional data allowed for a sample of only practicing school psychologists currently employed in schools. Next, a short demographic questionnaire was presented followed by the survey instrument which was created by the researcher through a modified compilation of previous studies on the concussion knowledge level and practice and each participant’s understanding of return-to-learn guidelines.
Reliability and Validity of Measures

Due to the nature and style of questioning aimed at capturing faculty members’ current concussion knowledge, confidence in their knowledge, and current engagement in concussion management protocols, a reliability analysis to determine the internal consistency of the instrument was not warranted.

In the first segment, questions centered on basic demographic data and work history. Gender, age, ethnicity, community of the school district (e.g., urban, rural, suburban), highest degree, practicing qualifications, and years working as a school psychologist were among the demographic questions that were asked in order to gain an understanding of the participants in the sample. Also in the demographic section, professional experience questions were also asked, such as how many students they had worked with who had suffered a concussion, and two Likert scale questions asking participants to rate their knowledge of concussions and information relating to concussion recognition.

The second section included a 21-item concussion/TBI knowledge questionnaire that was used in previously mentioned literature and was found to be related to school psychologist’s current knowledge of concussions and management of concussions in schools (Eftaxas & Canto, 2020).

The last two sections were based on a model by Davies (2016) which was adapted from National Children’s Hospital’s Concussion Toolkit (Nationwide Children’s Hospital, 2012). The resulting questions were designed to ask specific questions that pertained to each step of the model.
Data Analysis

Raw data were exported from the web-based survey host, Qualtrics, for analysis. Following data gathering, data were cleansed and entered into statistical analysis tools (SPSS). Data cleansing consisted of removing data from participants who did not fit the criteria for participation in the survey, as well as removing data from participants who provided incomplete survey responses. Identification numbers were generated for each participant response and any identifiable information, non-responders, or duplicate responders were deleted.

Variables were renamed for consistency and analysis simplicity. All variables were subjected to frequency analysis to validate that the number of responses in the dataset matched the number of research participants, that variable coding was accurate, that no incorrect or inconsistent values were present, and that probable missing data were identified. After implementing variable frequency operation, all observable issues were resolved as previously explained.

Preliminary Data Analysis

Descriptive statistics were utilized to describe the population, knowledge of concussion, and current practices of return-to-learn following concussions and was summarized as follows: categorical data (e.g., gender, age, ethnicity, school community, degree, credentials, and number of children supported with concussion) and frequency counts. For continuous data (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience), distribution means and standard deviations were examined, assumptions for normal distribution were measured (e.g., scatterplot, frequency histogram), and measures of central tendency and variance were computed (i.e., mean, range, standard deviation, variance,
skewness, kurtosis). Pearson’s correlation coefficient were computed to examine the intercorrelations among continuous variables (concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience).

Last, multiple linear regression equations were calculated to examine the predictive relationship between school psychologists’ perceived competence to engage in each step of a school-based concussion management model based on the contribution of each independent variable (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development). The overall variance in educational placement was accounted for by the model, and the individual contribution of each independent variable was determined by the regression equation. When appropriate, the Chi-Square statistic was used to compare knowledge level of concussions between those with previous experience with concussions and those without experience.

**Checking Statistical Assumptions**

Before executing the independent t-test, the following statistical hypotheses were verified: the dependent variable must be continuous; independence, which indicates that the observations are independent of one another; one independent variable consists of two categorical groups; no significant outliers in the two groups of the dependent variable; normality, which indicates that the dependent variable should be normally distributed; and homogeneity of variance, which indicates that the two groups have the same variance (Casson & Farmer, 2014).

Prior to multiple linear regression modeling, the assumptions of regression, such as measures of normality, homogeneity, linearity, and variance, were analyzed by examining
skewness/kurtosis and Levene’s tests, to determine the fit of the variables. The homogeneity of variance assumption was tested in order to show that the population had equal variance. Additionally, the distribution within the population surveyed was checked for normality and there was assurance that each variable was independently sampled, meaning each variable only provides one value. The statistical assumptions of normality, linearity, multicollinearity, and homoscedasticity passed a preliminary analysis. If the assumptions were deemed to be violated, follow-up statistical testing and/or transformations were conducted. Means, standard deviations, and bivariate relationships were measured using descriptive statistics, Pearson correlations, independent samples t-tests, and chi-square tests. After this was performed, predictors were entered into the multiple linear regressions which align with research questions four.

**Research Question 1**

What is the current state of school psychologists’ knowledgeable of pediatric concussion/mTBI symptoms and outcomes?

**Analysis of Research Question 1.** To address research question one, descriptive statistics (i.e., frequency, mean, standard deviation, range, skewness, kurtosis) were computed. To determine school professionals’ knowledge about concussion and management, responses from the T/F questions were converted to a score of 1 for correct and 0 for incorrect/don’t know responses within Qualtrics. The number of correct items was summed, and a percentage correct computed for each item. Total points were summed for each participant to produce a Total Concussion Knowledge score. Overall, a higher knowledge score reflected higher knowledge accuracy.
**Research Question 2**

Where (i.e., graduate coursework, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience) do school psychologists acquire concussion/mTBI knowledge?

**Analysis of Research Question 2.** Research question 2 was answered using frequency calculations. The total number of variables where school psychologist’s acquire knowledge was calculated.

**Research Question 3**

How do school psychologists rate their competence to engage in each step of a school-based concussion/mTBI management model?

**Analysis of Research Question 3.** Research question 3 was answered using frequency calculations. The total score for how competent school psychologist’s feel engaging in each step of a concussion management model was calculated.

**Research Question 4**

What factors (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience) predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model?

**Analysis of Research Question 4.** The assumptions of multiple linear regression were analyzed in order to answer research four. Multiple linear regression is a statistical approach that models the relationship between a dependent variable and several independent variables. Statistical significance for all eight models was set at $p \leq 0.05$. Next the predictors were simultaneously entered in their respective multiple linear regressions in order to determine the
level at which they predict school psychologists perceived competence to engage in each step of a school-based concussion management model. The utilization of a regression model calculated eight different criteria to predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model based on the contribution of each independent variable (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience).

Research Question 5

Do school psychologists report having been involved in each step of a school-based concussion management model?

Analysis of Research Question 5. For research question 5, frequencies and percentages were calculated to address SPs’ current practices. The total number of steps that school psychologists report being involved in was calculated.

Ethical Considerations

Ethical considerations were given throughout the study with regards to access, confidentiality, and consent. Due to the nature of this research, no personal details were asked while carrying out the primary research. Remote data collection methods were utilized. As such, participation in this research poses no threat to their health or safety, and all personal information of the school psychologists will be confidential. The archival assessment data was delivered electronically to the researcher with de-identified information. Additionally, they will be allowed to discontinue their participation at any point during data collection. Their participation will expand research on this topic and help to expand knowledge in this area with this population. The researcher conducted this study, which had no potential risk for harm present. Individual
student assessment data will remain confidential as it applies to each participant, and it will not be made available to the public or the researcher. No conflict of interest was present in this study.

Summary

Despite their importance in students' concussion recovery, few studies have looked into school psychologists' experiences with concussion, specifically their knowledge of the injury and their roles when supporting students with concussion. This study adds to the body of knowledge on the subject. Findings from the study explore factors influencing the development of school psychologist’s concussion knowledge, confidence, and practices in supporting children post-concussions. This research also sought to compare both concussion knowledge and the factors contributing to competence of school psychologists practicing in public schools, and number of students with concussions served. The results were examined and presented in order to get an understanding of school psychologists' mTBI knowledge and confidence with that information, to better comprehend existing practices and future training needs.

After receiving permission to conduct the study and collect email addresses from each individual school's public website, an email with a link to the survey was sent to each school psychologist. Once the participants submitted the survey, it was added to the data collection anonymously. Anonymity was maintained, and the rights and well-being of the study sample of participants were protected, because the data were delivered to the researcher with non-identifiable information. The data was delivered electronically with line numbers rather than participant names. This study was carried out by the researcher with no potential for harm. This study contained no conflicts of interest. Electronic data will be destroyed after three years by
permanently erasing it from the external hard drives. There will be no hard copies made as a result of this study. IBM SPSS Statistics Version 27 was used for all data analyses.

To begin, screening and cleaning procedures were used to assess assumptions and missing data. Descriptive statistics were used to describe the population, concussion knowledge, and current practices of return-to-learn after concussions. The Chi-Square statistic was used when appropriate to compare knowledge level of concussions between doctoral and non-doctoral degrees.
CHAPTER IV: DATA ANALYSES AND RESULTS

The purpose of this chapter is to present the findings of this quantitative and correlational study. This research study included a 31-item questionnaire that aimed to assess both school psychologist knowledge of concussions and perception of competence to engage in individual steps of a concussion management model.

In this chapter, the major findings of the concussion/mTBI knowledge questionnaire are presented in order to test the hypotheses and analyze potential population differences in response to the five research questions. The questionnaire results were analyzed using descriptive and inferential statistics for demographic characteristics, followed by regression equations examining the predictive relationship between perceptions of competencies to engage in current school-based concussion management procedures and implementation characteristics (i.e., knowledge of concussions, highest degree, graduate coursework, years of experience, supervised clinical experience, formal and independent professional development). Both descriptive and predictive questions may inform the design and implementation of concussion management protocols in schools.

The purpose of the present study is to investigate the factors that influence the development of school psychologists' concussion knowledge, confidence, and practices in supporting children following concussion. In addition, the research questions were formulated to increase the breadth of literature in an underdeveloped subfield of school psychology and to develop an integrated method that promotes a comprehensive understanding of school psychologists' experiences with pediatric concussions.
Descriptive Analyses

Participants

Among the 1,519 potential participants that were recruited by email, 207 participants engaged the survey. Of the 207 returned, 22 participants did not respond to the majority of the survey and were therefore excluded from the analysis. The final sample is comprised of 179 participants.

Table 1 shows the percentages of the participant’s age, gender, highest level of education completed, and practice credentials. The psychologists’ mean age was between 36 and 45 (29.1%, \( n=52 \)) years; however, ages 25 to 35 (34.1%, \( n=61 \)) and 46 to 59 (30.9%, \( n=56 \)) were the age ranges with higher response rates. The age range with the most participants was 25-35 years (61%), followed by 46-59 (55%), 36-45 (52%), and then 60+ years (5.6%). Most of the participants were female (81.6%, \( n=146 \)). The overall number of years employed as a school psychologist ranged from 1 to 40, with a mean of 13.5 years (SD = 8.7). The majority attained or completed a master’s or specialist degree (78.8%, \( n=141 \)). A doctoral degree was earned by 21.2% (\( n=38 \)) of participants. A majority (57%) of the responding school psychologists work in suburban school districts. More than half of school psychologists (63%) indicated that they had worked with 1–5 students with TBI within a school setting while 8.4% reported no experience working with a student with a TBI.
### Table 1

*Participant Demographics*

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<th>Variable</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
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<tr>
<td>Male</td>
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<tr>
<td><strong>Age in years</strong></td>
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<tr>
<td>25-35</td>
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<tr>
<td>36-45</td>
<td>52</td>
<td>29.1</td>
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<tr>
<td>46-59</td>
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<td>30.7</td>
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<tr>
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<td>5.6</td>
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<td>2.8</td>
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<tr>
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<td>Few (1-5)</td>
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<tr>
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</tr>
<tr>
<td>Many (&gt;11)</td>
<td>14</td>
<td>7.8</td>
</tr>
</tbody>
</table>

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Preliminary Data Screening and Checking Assumptions

Before descriptive and inferential analyses were conducted, the data was first evaluated to screen for outliers, missing values, and test assumptions. Outliers were identified by calculating Mahalanobis Distance in a preliminary regression procedure. A critical value was established and served as a criterion for comparing Mahalanobis values. 13 cases exceeded this critical value and therefore were identified as outliers requiring further investigation. Each case was then examined using visual models, descriptive statistics, cook’s distance, leverage values, and tests of normality. For the present study, outliers were eliminated to guard against future distortion of statistical results. Nearly half of the cases were likely a result of data entry errors, evidenced by extreme values far greater than the highest available.

Distribution means and standard deviations were examined for continuous data (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, formal professional development, independent professional development, previous work experience) and were reported (Table 2). The first step is to build forecasting model by checking assumptions of data. There are four assumptions that should be check which are normality, linearity, heteroscedasticity and multicollinearity. All of the variables in this paper must be normal distribution. Assumptions for normal distribution were measured (e.g., plot P-P, plot Q-Q, frequency histogram) and measures of central tendency and variance computed (i.e., mean, range, standard deviation, variance, skewness, kurtosis). If the distribution of data is not normal, so we need to use transformation.

The third assumption is any data should be free from heteroscedasticity. Heteroscedasticity will happen whenever there is interruption in the model that not fulfilled. If the important variables in the model are missing, hence heteroscedasticity will happen. Any
model can be check whether there is heteroscedasticity or not based on Spearman’s rank correlation test. The last assumption that should be checked in research is multicollinearity. Multicollinearity means situation that has high degree of correlation between controlled variables. Any analyses can be known the present of multicollinearity by checking the value of variation inflation factor (VIF).

Visual analysis of distributions of the seven independent variables (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, previous work experience, formal professional development, and independent professional development) suggested that the assumption of normality had been violated (Appendix C). These data did not have a normal distribution.

The assumptions of linearity, multivariate normality, no multicollinearity, and homoscedasticity were evaluated (Tabachnick & Fidell, 2007). Concussion/mTBI Knowledge accuracy scores were entered as the dependent variable into the model with independent variables as previous job experience, highest degree, years of experience, supervised clinical experience, previous work experience, formal professional development, and independent professional development. There was apparent linearity as determined by partial regression plots and a plot of studentized residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.97 and homoscedasticity was assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. In terms of outliers, there were two residuals greater than ±2.5 standard deviations (-3.33 and 3.51). Casewise diagnostics showed no leverage values greater than 0.2, and values for Cook's distance were <1.0. Residuals were normally distributed as assessed by inspection of a normal probability plot. The assumption of normality was met, as assessed by a Q-Q plot with normally distributed
residuals. The scatterplot showed that there was a strong positive relationship between the variables, indicating linearity. Therefore, all assumptions are tenable. Overall, for all independent variables the residuals were generally, randomly, and symmetrically distributed around zero. Multicollinearity was not indicated (VIF=1 for all variables). Therefore, all assumptions are tenable. Univariate and multivariate outliers were tested and accounted for within this sample. Multivariate outliers were kept within the data for these analyses because removal of outliers did not impact the findings.

Regression coefficients, standard errors, VIF, and tolerance are found in Table 3. TBI Knowledge Questionnaire, years of experience as a school psychologist, formal professional development, and independent professional development activities (e.g., reading of journal articles, books, chapters) were found to be a statically significant (p < .05) predictor with concussion knowledge. Results of the multiple regression analysis are displayed in Table 4. Regression results indicated the overall model of seven predictors was statistically significant (p < .01) and accounted for 42% of the variance in overall perceived competence to engage in school-based concussion model (R² = .444, Adjusted R² = .416, F(7, 159) = 17.89, p < .01; see Table 4). Based on the ANOVA summary table results, overall perceived competence to engage in school-based concussion model was significantly different based on the participants’ TBI knowledge score, degree, years of experience, supervised clinical experience, formal and independent professional development, and previous work experience, F(7, 159) = 17.89, p < .01 (Table 5).
Table 2

Descriptive statistics for continuous data

<table>
<thead>
<tr>
<th></th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Min.</td>
</tr>
<tr>
<td>TBI knowledge score</td>
<td>179</td>
<td>1</td>
</tr>
<tr>
<td>Self-rank your</td>
<td>177</td>
<td>1</td>
</tr>
<tr>
<td>Rate your level of</td>
<td>177</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. PD = Professional Development.

Table 3

Regression Coefficients

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>5.329</td>
<td>1.242</td>
<td>4.292</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBI knowledge score</td>
<td>.202</td>
<td>.040</td>
<td>.330</td>
<td>5.103</td>
<td>&lt;.001</td>
<td>.840</td>
<td>1.190</td>
</tr>
<tr>
<td>Highest degree</td>
<td>.454</td>
<td>.322</td>
<td>.088</td>
<td>1.412</td>
<td>.160</td>
<td>.901</td>
<td>1.110</td>
</tr>
<tr>
<td>Years of experience</td>
<td>-.668</td>
<td>.333</td>
<td>-.131</td>
<td>-2.006</td>
<td>.047</td>
<td>.825</td>
<td>1.213</td>
</tr>
<tr>
<td>Supervised clinical</td>
<td>.277</td>
<td>.279</td>
<td>.063</td>
<td>.994</td>
<td>.322</td>
<td>.866</td>
<td>1.154</td>
</tr>
<tr>
<td>experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-.120</td>
<td>.278</td>
<td>-.284</td>
<td>-4.330</td>
<td>&lt;.001</td>
<td>.817</td>
<td>1.224</td>
</tr>
<tr>
<td>Independent PD</td>
<td>-.927</td>
<td>.286</td>
<td>-.208</td>
<td>-3.242</td>
<td>.001</td>
<td>.858</td>
<td>1.166</td>
</tr>
<tr>
<td>Previous work</td>
<td>-.098</td>
<td>.275</td>
<td>-.022</td>
<td>-.355</td>
<td>.723</td>
<td>.889</td>
<td>1.125</td>
</tr>
</tbody>
</table>

Note. B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 4

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R²</th>
<th>ΔR²</th>
<th>SE</th>
<th>R² Change</th>
<th>F Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
<th>Durbin-Watson</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.664a</td>
<td>.441</td>
<td>.416</td>
<td>1.622</td>
<td>.441</td>
<td>17.889</td>
<td>7</td>
<td>159</td>
<td>&lt;.001</td>
<td>1.972</td>
</tr>
</tbody>
</table>

Note. p < .05; ΔR² = Adjusted R²; SE = standard error of the coefficient.
Table 5

ANOVA Summary Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>329.618</td>
<td>7</td>
<td>47.088</td>
<td>17.889</td>
<td>&lt;.001b</td>
</tr>
<tr>
<td>Residual</td>
<td>418.537</td>
<td>159</td>
<td>2.632</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>748.156</td>
<td>166</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Question 1

What is the current state of school psychologists’ knowledgeable of pediatric concussion/mTBI symptoms and outcomes? The survey included 21 items regarding general knowledge of concussion and return to learn protocols, which the participants indicated either true, don’t know, or false. Only if the participant correctly identified the answer as true or false was the item counted as correct. Items that had “don’t know” as the response were counted as incorrect. The mean TBI knowledge score for school psychologists was 14.9 (SD = 3.48) out of 21 total correct possible. This equates to approximately 71% correct on average. Table 6 displays the percentage of correct responses for each of the 21 items.
Table 6

Number and Percent of Participants that Correctly Answered TBI Knowledge Questionnaire

*Items (n = 179)*

<table>
<thead>
<tr>
<th>Item Description</th>
<th>n</th>
<th>% correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A concussion is a TBI</td>
<td>152</td>
<td>84.9</td>
</tr>
<tr>
<td>2. All head injuries are TBIs</td>
<td>137</td>
<td>76.5</td>
</tr>
<tr>
<td>3. Most damage caused by a TBI is apparent right away</td>
<td>158</td>
<td>88.3</td>
</tr>
<tr>
<td>4. Traumatic Brain Injury is one of the classes of disability for which students are eligible to receive special education services under IDEA</td>
<td>164</td>
<td>91.6</td>
</tr>
<tr>
<td>5. Once a child is walking and talking normally after a TBI, there should be few, if any, aftereffects from the injury</td>
<td>161</td>
<td>89.9</td>
</tr>
<tr>
<td>6. The amount of visible physical damage to the brain determines whether a TBI is classified as Mild, Moderate, or Severe</td>
<td>95</td>
<td>53.1</td>
</tr>
<tr>
<td>7. A stroke can be a form of TBI</td>
<td>50</td>
<td>27.9</td>
</tr>
<tr>
<td>8. A child must be unconscious after an accident for a TBI to have occurred</td>
<td>162</td>
<td>90.5</td>
</tr>
<tr>
<td>9. Most of the children who have had a TBI receive special education services</td>
<td>121</td>
<td>67.6</td>
</tr>
<tr>
<td>10. Most traumatic brain injuries are considered mild</td>
<td>60</td>
<td>33.5</td>
</tr>
<tr>
<td>11. A child who is injured when s/he is very young should continue to develop in an emotionally and intellectually normal way</td>
<td>90</td>
<td>50.3</td>
</tr>
<tr>
<td>12. If a child does not develop an emotional disorder one year after the TBI, s/he will not</td>
<td>114</td>
<td>63.7</td>
</tr>
<tr>
<td>13. If a child performs at normal levels post-TBI on cognitive tests, s/he will do just as well in school as before the injury</td>
<td>108</td>
<td>60.3</td>
</tr>
<tr>
<td>14. Slowed processing speed may be an aftereffect of a concussion</td>
<td>164</td>
<td>91.6</td>
</tr>
<tr>
<td>15. Depending on the severity of the TBI, a student may be at a greater risk for grade</td>
<td>126</td>
<td>70.4</td>
</tr>
<tr>
<td>16. After a mild to moderate TBI, children may display symptoms of anxiety and depression</td>
<td>168</td>
<td>93.9</td>
</tr>
<tr>
<td>17. Students should return to school and resume all normal activities after sustaining a TBI</td>
<td>155</td>
<td>86.6</td>
</tr>
<tr>
<td>18. Exerting strenuous cognitive or physical energy before symptoms are gone may lead to a worsening of symptoms.</td>
<td>142</td>
<td>79.3</td>
</tr>
<tr>
<td>19. Students who don’t allow time for cognitive rest may take longer to fully recover</td>
<td>161</td>
<td>89.9</td>
</tr>
<tr>
<td>20. Most concussions (mild TBIs) resolve within 3 weeks of the injury</td>
<td>73</td>
<td>40.8</td>
</tr>
<tr>
<td>21. Students who sustained a TBI are entitled to accommodations (via a 504 plan) when symptoms last less than 3 weeks, or modifications (IEP) when symptoms last longer</td>
<td>104</td>
<td>58.1</td>
</tr>
</tbody>
</table>
Of these 21 items, four items were answered correctly by over 90% of participants. Interestingly, three items were answered incorrectly by over half of participants. For example, item 7 read, “A stroke can be a form of a TBI,” The answer to this question is false and 72.1% incorrectly responded true. Item 10 read, “Most traumatic brain injuries are considered mild.” This answer to this question is true, though 66.5% incorrect responded false. Finally, item 20 read, “Most concussions (mTBI) resolve within 3 weeks of the injury.” The answer to this question is true, though 59.2% incorrectly responded false.

For items 10-11 asked school psychologists to rate themselves on their knowledge about concussions and knowledge pertaining to the recognition of concussions on a 10-point Likert scale (Item 11: “How would you rate your level of knowledge pertaining to the recognition of concussions?”). The majority rated themselves at a 5 (14.5%), which is exactly neutral. Only 2.2% (n=4) of school psychologists indicated that they were experts, while 4.5% (n=8) indicated that they were a novice. Similarly, 177 participants rated their knowledge pertaining to the recognition of concussions. In total, 12.3% (n=22) rated themselves at a 4, which is just below neutral. Only 1.1% (n=2) of school psychologists indicated that they were experts, and 8.4% (n=15) rated that they were novice.

Research Question 2

Research question two asked where (i.e., graduate coursework, supervised clinical experience, previous work experience, formal professional development, independent professional development) do school psychologists acquire concussion/mTBI knowledge? The school psychologists were asked where they had received education on concussion management. Table 7 displays the sources of concussion training reported by the participants. Twenty-three percent (n=41) of participants reported receiving no formal training regarding concussions, while
77% (n=138) did report previous training. Of the 77% that did engage in formal concussion training, the participants most often reported the concussion training was obtained through years of experience as a school psychologist and independent professional development (e.g., reading of journal articles, books, chapters).

### Table 7

**Sources of Concussion Training (n = 179)**

<table>
<thead>
<tr>
<th>Source</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of experience as a school psychologist</td>
<td>138</td>
<td>77.1</td>
</tr>
<tr>
<td>Supervised clinical experience (e.g., practicum, internship, post-doc)</td>
<td>49</td>
<td>27.4</td>
</tr>
<tr>
<td>Formal continuing professional development activities (e.g., workshops)</td>
<td>89</td>
<td>49.7</td>
</tr>
<tr>
<td>Independent continuing professional development activities (e.g., reading of journal articles, books, chapters)</td>
<td>116</td>
<td>64.8</td>
</tr>
<tr>
<td>Previous job experience providing services to a student with a concussion</td>
<td>68</td>
<td>38.0</td>
</tr>
<tr>
<td>No previous concussion training</td>
<td>41</td>
<td>22.9</td>
</tr>
</tbody>
</table>

**Research Question 3**

Research questions three asked, how do school psychologists rate their competence to engage in of each step of a school-based concussion/mTBI management model? Participants were asked to rate their overall level of competence to engage in each step of a school-based concussion management model on a 5-point Likert scale 1 = no competence, 2 = some competence, 3 = minimal standard of competence, 4 = advanced competence, and 5 = exceptional competence. The concussion management model was a modified version of Davies (2015) 7-step protocol. Table 8 presents participants’ perceptions of their ability to provide support engaging in each step of a school-based concussion management model. School psychologists felt the least confident engaging Item 4 “If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the
concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.”

**Table 8**

*Perceived Competence to Engage in Steps of a School-Based Concussion Management Model*

<table>
<thead>
<tr>
<th>Step</th>
<th>M</th>
<th>SD</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.</td>
<td>2.54</td>
<td>1.21</td>
<td>94</td>
<td>52.6</td>
</tr>
<tr>
<td>2. Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication.</td>
<td>3.01</td>
<td>1.17</td>
<td>116</td>
<td>64.7</td>
</tr>
<tr>
<td>3. Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment.</td>
<td>3.27</td>
<td>1.09</td>
<td>133</td>
<td>74.3</td>
</tr>
<tr>
<td>4. If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.</td>
<td>2.22</td>
<td>1.09</td>
<td>73</td>
<td>40.8</td>
</tr>
<tr>
<td>5. If no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs.</td>
<td>3.10</td>
<td>1.11</td>
<td>120</td>
<td>66.9</td>
</tr>
<tr>
<td>6. Develop and distribute a written plan for adjusting the learning environment and academic expectations.</td>
<td>2.96</td>
<td>1.11</td>
<td>113</td>
<td>63.1</td>
</tr>
<tr>
<td>7. Identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required.</td>
<td>2.59</td>
<td>1.09</td>
<td>90</td>
<td>50.3</td>
</tr>
</tbody>
</table>

*Note.* 1 = no competence; 2 = some competence; 3 = minimal standard of competence; 4 = advanced competence; 5 = exceptional competence.

**Research Question 4**

Research question four asked, what factors (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, previous work experience,
formal professional development, independent professional development) predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model?

The assumptions of multiple linear regression were analyzed and previously discussed in order to answer research questions four. In this research, the stepwise method of regression was utilized for these analyses. Stepwise is a method for regressing several variables that eliminates the least linked variables. Variables that best explain the distribution are the product of a stepwise regression. Regression analysis revealed that there was no correlation between knowledge, abilities, and attitude.

The assumptions of eight multiple linear regressions were analyzed in order to answer research questions four to determine whether TBI knowledge questionnaire total score, highest degree, years of experience, supervised clinical experience, previous job experience, formal and independent professional development activities (independent variables) were associated with higher perceived competence to engage in each step of a school-based concussion management model. After the assumptions were met, the predictors were simultaneously entered in their respective multiple linear regressions in order to determine the level at which they predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model. The impact subscale, informal procedures subscale, and recent concussion experience were used as the dependent variables in the multiple regression analyses. Statistical significance for all seven models was set at $p \leq .05$. For this perceived competence equation, the unstandardized regression coefficients were examined for the concussion/mTBI knowledge score, highest degree, graduate coursework, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional
development to examine their predictive relationship with perceived competence to engage in a school-based concussion management model (dependent variable). To determine if these seven predictor variables were significant, the t-statistic was used to determine if the beta weights obtained were significantly different from zero. If the t-statistic is significant, this indicates that the predictor sufficiently explains the dependent variable variance. Results of the multiple regression analysis including regression coefficients, standard errors, zero-order and semi-partial correlations are presented in Table 9-15.

As shown in Table 9, concussion knowledge contributed 21.3% of the variance in perceived competence to complete step 1. Formal professional development contributed to 5.4% more. Adding supervised clinical experiences contributed 3% more. All three together accounts for 28.4% variance ($R^2=.297$, Adjusted $R^2 = .284$, $F(7,165) = 6.97, p=.009$; see Table 9). Overall, what actually matters for school psychologist perceived competence to develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI is supported by concussion knowledge, with some formal professional development and supervised clinical experience.

Table 9

Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 1

<table>
<thead>
<tr>
<th>Model 1</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>$R^2$</th>
<th>Δ$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concussion knowledge</td>
<td>.160</td>
<td>.024</td>
<td>.462</td>
<td>6.727</td>
<td>&lt;.001</td>
<td>.213</td>
<td>.213</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.141</td>
<td>.024</td>
<td>.408</td>
<td>5.983</td>
<td>&lt;.001</td>
<td>.267</td>
<td>.054</td>
</tr>
<tr>
<td>Formal PD</td>
<td>-.567</td>
<td>.163</td>
<td>-.238</td>
<td>-3.490</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.135</td>
<td>.023</td>
<td>.391</td>
<td>5.803</td>
<td>&lt;.001</td>
<td>.297</td>
<td>.030</td>
</tr>
<tr>
<td>Formal PD</td>
<td>-.527</td>
<td>.160</td>
<td>-.221</td>
<td>-3.286</td>
<td>.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Supervised experience         - .431    .163  - .174   -2.639  .009

Note. p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

As shown in Table 10, concussion knowledge contributed 12.2% of the variance in perceived competence to complete step 2. Highest degree contributed to 7% more. Both factors account for 19.2% variance (R²=.201, Adjusted R² = .192, F(7,166) = 315.47, p < .001; see Table 10). Overall, school psychologist perceived competence to make initial contact with the student and family following a concussion/TBI to facilitate good communication is supported by concussion knowledge and highest degree.

Table 10

Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 2

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.120</td>
<td>.024</td>
<td>.356</td>
<td>4.928</td>
<td>&lt;.001</td>
<td>.127</td>
<td>.127</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.117</td>
<td>.023</td>
<td>.345</td>
<td>4.974</td>
<td>&lt;.001</td>
<td>.201</td>
<td>.074</td>
</tr>
<tr>
<td>Highest degree</td>
<td>.768</td>
<td>.195</td>
<td>.273</td>
<td>3.933</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 11 shows concussion knowledge contributed to 19.9% of the variance in perceived competence to complete step 3. Formal professional development contributed to 4.9% more. Adding years of experience contributed 1.8% more. All factors account for 26.2% variance (R²=.275, Adjusted R² = .262, F(7,165) = 4.17, p = .043; see Table 11). Overall, school psychologist perceived competence to use documentation from medical professionals that may
specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment is supported by concussion knowledge, formal professional development, and years of experience as a school psychologist.

**Table 11**

*Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 3*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>ΔR²</th>
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<tr>
<td>Concussion knowledge</td>
<td>.143</td>
<td>.022</td>
<td>.452</td>
<td>6.545</td>
<td>&lt;.001</td>
<td>.204</td>
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<td>.022</td>
<td>.399</td>
<td>5.807</td>
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</tr>
<tr>
<td>Formal PD</td>
<td>-.512</td>
<td>.149</td>
<td>-.235</td>
<td>-3.428</td>
<td>&lt;.001</td>
<td>.275</td>
<td>.018</td>
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<td>.275</td>
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</tr>
<tr>
<td>Concussion knowledge</td>
<td>.118</td>
<td>.022</td>
<td>.372</td>
<td>5.379</td>
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<tr>
<td>Formal PD</td>
<td>-.415</td>
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<td>-.191</td>
<td>-2.674</td>
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<tr>
<td>Years of experience</td>
<td>-.382</td>
<td>.187</td>
<td>-.147</td>
<td>-2.042</td>
<td>.043</td>
<td></td>
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</tr>
</tbody>
</table>

*Note.* p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 12 shows formal professional development contributed to 23.5% of the variance in perceived competence to complete step 4. Adding years of experience as a school psychologist, highest degree, concussion knowledge, previous job experience contributed to 13% more variance. All factors account for 36.9% variance (R²=.388, Adjusted R² = .369, F(7,162) = 4.89, p = .029; see Table 12). Overall, school psychologist perceived competence to conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive is supported by formal professional development, years of experience as a school psychologist, highest degree, and concussion knowledge.
Table 12

Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 4

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
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<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-1.054</td>
<td>.146</td>
<td>-.490</td>
<td>-7.233</td>
<td>&lt;.001</td>
<td>.240</td>
<td>.240</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-0.858</td>
<td>.150</td>
<td>-.398</td>
<td>-5.731</td>
<td>&lt;.001</td>
<td>.300</td>
<td>.061</td>
</tr>
<tr>
<td>Years of experience</td>
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<td>.179</td>
<td>-.263</td>
<td>-3.782</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
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<tr>
<td>Formal PD</td>
<td>-0.805</td>
<td>.147</td>
<td>-.374</td>
<td>-5.468</td>
<td>&lt;.001</td>
<td>.336</td>
<td>.036</td>
</tr>
<tr>
<td>Years of experience</td>
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<td>.175</td>
<td>-.249</td>
<td>-3.660</td>
<td>&lt;.001</td>
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</tr>
<tr>
<td>Highest degree</td>
<td>.501</td>
<td>.168</td>
<td>.193</td>
<td>2.986</td>
<td>&lt;.001</td>
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<tr>
<td>Model 4</td>
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</tr>
<tr>
<td>Formal PD</td>
<td>-0.738</td>
<td>.146</td>
<td>-.343</td>
<td>-5.067</td>
<td>&lt;.001</td>
<td>.370</td>
<td>.033</td>
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<tr>
<td>Years of experience</td>
<td>-0.547</td>
<td>.174</td>
<td>-.212</td>
<td>-3.141</td>
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<tr>
<td>Highest degree</td>
<td>.503</td>
<td>.164</td>
<td>.194</td>
<td>3.071</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.060</td>
<td>.020</td>
<td>.191</td>
<td>2.942</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-0.703</td>
<td>.145</td>
<td>-.327</td>
<td>-4.857</td>
<td>&lt;.001</td>
<td>.388</td>
<td>.018</td>
</tr>
<tr>
<td>Years of experience</td>
<td>-0.499</td>
<td>.173</td>
<td>-.194</td>
<td>-2.878</td>
<td>&lt;.001</td>
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</tr>
<tr>
<td>Highest degree</td>
<td>.494</td>
<td>.162</td>
<td>.190</td>
<td>3.052</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous job experience</td>
<td>.052</td>
<td>.020</td>
<td>.168</td>
<td>2.578</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 13 shows concussion knowledge contributed to 13.2% of the variance in perceived competence to complete step 5. Formal professional development contributed to 5.9% more. Both factors account for 19.1% variance (R²=.201, Adjusted R² = .191, F(7,165) = 13.10, p < .001; see Table 13). Overall, school psychologist perceived competence to assess the students’ academic needs if no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing is supported by concussion knowledge and formal professional development.
Table 13

*Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 5*

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R^2</th>
<th>ΔR^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>.137</td>
<td>.137</td>
<td>.137</td>
<td>5.144</td>
<td>&lt;.001</td>
<td></td>
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</tr>
<tr>
<td>Concussion knowledge</td>
<td>.116</td>
<td>.023</td>
<td>.371</td>
<td>5.144</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>.201</td>
<td>.063</td>
<td>.201</td>
<td>4.371</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.098</td>
<td>.022</td>
<td>.312</td>
<td>4.371</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-.559</td>
<td>.155</td>
<td>-.259</td>
<td>-3.620</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. p < .05; ΔR^2 = R^2 Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 14 shows years of experience as a school psychologist contributed to 12.1% of the variance in perceived competence to complete step 6. Concussion knowledge contributed to 6% more. Adding formal professional development contributed 3% more. All factors account for 22% variance (R^2=.234, Adjusted R^2 = .220, F(7,165) = 9.28, p = .003; see Table 14). Overall, school psychologist perceived competence to develop and distribute a written plan for adjusting the learning environment and academic expectations is supported by years of experience as a school psychologist, formal professional development, and concussion knowledge.

Table 14

*Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 6*

<table>
<thead>
<tr>
<th>Model</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R^2</th>
<th>ΔR^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
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<td>.126</td>
<td>.126</td>
<td>4.906</td>
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</tr>
<tr>
<td>Years of experience</td>
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<td>.190</td>
<td>-.355</td>
<td>-4.906</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>.191</td>
<td>.065</td>
<td>.191</td>
<td>4.021</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years of experience</td>
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<td>.189</td>
<td>-.290</td>
<td>-4.021</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concussion knowledge</td>
<td>.084</td>
<td>.023</td>
<td>.263</td>
<td>3.649</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td>.234</td>
<td>.043</td>
<td>.234</td>
<td>3.649</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Years of experience  -.580  .194  -.221  -2.997  .003  
Concussion knowledge  .073  .023  .229  3.224  .002  
Formal PD  -.490  .161  -.224  -3.047  .003

Note. p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.

Table 15 shows formal professional development contributed to 13.7% of the variance in perceived competence to complete step 7. Concussion knowledge contributed to 7% more. Adding years of experience contributed 2% more. All factors account for 22.3% variance (R²=.236, Adjusted R² = .223, F(7,165) = 5.45, p = .021; see Table 15). Overall, school psychologist perceived competence to identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required is supported by formal professional development, concussion knowledge, and years of experience as a school psychologist,

Table 15

Linear Regression Model Results for Predictors to Engage in School-based Concussion Management Model – Step 7

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p</th>
<th>R²</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
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<tr>
<td>Formal PD</td>
<td>-.798</td>
<td>.152</td>
<td>-.377</td>
<td>-5.261</td>
<td>&lt;.001</td>
<td>.142</td>
<td>.142</td>
</tr>
<tr>
<td>Model 2</td>
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<td></td>
</tr>
<tr>
<td>Formal PD</td>
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<td>.150</td>
<td>-.316</td>
<td>-4.471</td>
<td>&lt;.001</td>
<td>.211</td>
<td>.069</td>
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<td>Concussion knowledge</td>
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<td>.270</td>
<td>3.811</td>
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<td></td>
</tr>
<tr>
<td>Formal PD</td>
<td>-.559</td>
<td>.155</td>
<td>-.264</td>
<td>-3.604</td>
<td>&lt;.001</td>
<td>.236</td>
<td>.025</td>
</tr>
<tr>
<td>Concussion knowledge</td>
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<td>.022</td>
<td>.239</td>
<td>3.359</td>
<td>&lt;.001</td>
<td></td>
<td></td>
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<tr>
<td>Years of experience</td>
<td>-.436</td>
<td>.187</td>
<td>-.172</td>
<td>-2.335</td>
<td>.021</td>
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</table>

Note. p < .05; ΔR² = R² Change; B = unstandardized regression coefficient; SE B = standard error of the coefficient; β = standardized coefficient.
Research Question #5

Research question five asked if school psychologists report having been involved in each of the steps of a school-based, concussion management model? Descriptive statistics were used to determine which step of a school-based concussion model school psychologists report engaging in. The information gathered focused on seven key areas of potential involvement that include prevention, assessment, intervention, progress monitoring, and consultation/collaboration that was an adaptation to the model developed by Davies (2016). Table 16 provides an overview of the data presented in the following sections. Overall, 73.2% \((n = 131)\) of the school psychologists report engaging in Item 3: “Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment.” 67.6% \((n=121)\) of school psychologists report to not engage in Item 5: “If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive” and 66.5% \((n=119)\) also report to not engage in Item 1: “Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.”
### Table 16

**Number and Percent of School Psychologists Who Have Previously Engaged in Steps of a School-Based Concussion Management Model (n=179)**

<table>
<thead>
<tr>
<th>Step Description</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.</td>
<td>60</td>
<td>33.5</td>
</tr>
<tr>
<td>2. Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication.</td>
<td>89</td>
<td>49.7</td>
</tr>
<tr>
<td>3. Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment.</td>
<td>131</td>
<td>73.2</td>
</tr>
<tr>
<td>4. If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.</td>
<td>58</td>
<td>32.4</td>
</tr>
<tr>
<td>5. If no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs.</td>
<td>107</td>
<td>59.8</td>
</tr>
<tr>
<td>6. Develop and distribute a written plan for adjusting the learning environment and academic expectations.</td>
<td>107</td>
<td>59.8</td>
</tr>
<tr>
<td>7. Identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required.</td>
<td>77</td>
<td>43.0</td>
</tr>
</tbody>
</table>

### Summary

School psychologists play an important role in the prevention, assessment, and intervention for the difficulties experienced after a student has developed a concussion. The purpose of this study is to examine school psychologists’ knowledge regarding concussion and perceived competence to engage in school-based concussion management procedures and reintegration.

The results of this survey suggest that in this sample of school psychologists, knowledge about concussions/TBI was surprisingly low. The school psychologists averaged a total score of
14.89 (SD=3.48) out of a possible 21, which corresponds to approximately 71% accuracy.

Similar rates of knowledge about TBI among school psychologists were reported more than 15 years ago by Hooper (2006), suggesting little change in TBI knowledge and awareness over time among these key school professionals. This study sought to determine the effect or influence of training, experience, and competence on the key content knowledge of concussions among practicing school psychologists, as measured by a TBI knowledge questionnaire. By determining these professionals' knowledge level and practice parameters, recommendations can be made to improve the return to learn process for students with a concussion.
CHAPTER V: DISCUSSION

The significance of school-based concussion management to aid in student recovery has been noted (Halstead et al., 2013; McAvoy, 2013; Sady et al., 2011), with a significant appeal for school psychologists to be appropriately trained and informed in head injury procedure (Bradley-Klug et al., 2013; NASP, 2015). Studies suggest that implementing return-to-learn guidelines may improve communication and promote the provision of appropriate academic accommodations to concussed students; however, these strategies have not been widely adopted by schools. To date there is no widespread adoption of concussion management procedures in the school setting. The content of the existing policies varies widely and may not take a multidisciplinary perspective.

The study first explored school psychologists’ knowledge of pediatric concussions and where they acquire concussion knowledge. The study then explored how competent they are to engage in each step of a school-based concussion management model. Although the majority of school psychologists felt competent to perform some of the core responsibilities of a school psychologist for supporting students with concussion (e.g., engaging in at least three or more of the seven steps of a school-based concussion management protocol), a surprisingly low percentage of the sample actually engaged in other important duties that are consistent with the roles of school psychologists. Only 33.5% of school psychologists reported they had developed and communicated a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.

Finally, the study explored different factors that influence competence, and school psychologists’ involvement in each step of a concussion management model. By understanding these factors, a school psychologist may better design and execute effective concussion
management protocols. This study provides meaningful information regarding school psychologists' knowledge and competence to effectively assist students with concussions in returning and succeeding in the classroom setting. The investigation also provides commentary on the role of current practicing school psychologists in the return-to-learn process for concussed students. The research further provides a comprehensive list of recommendations for enhancing school-based concussion education.

Surprisingly, multiple surveys of school psychologists perceive that they lack the necessary training, knowledge, and skills to effectively support students with TBI (Davies et al., 2013; Hooper, 2006). School psychologists in a survey of school psychologists endorsed several common misconceptions about TBI (Hooper, 2006), and 83% of the sample believed that their training was insufficient to work with this student population (Hooper, 2006). Davies conducted a survey of program directors and interns in 2013 to determine how prepared school psychologists are to identify and provide appropriate services for students with TBI. Davies discovered that none of the school psychology graduate programs dedicated a specific course to TBI, and that the majority of programs (75%, n = 42) only provided 61-90 minutes of instruction on the topic (Davies et al., 2013).

For these reasons, this research study is a preliminary step in examining factors considered to be predictive of mTBI/concussion knowledge in several areas pertinent to the work of school psychologists. As such, school psychologists represent a vital group of professionals impacted by this change in mTBI/concussion management.

**Interpretation of Major Findings**

The main findings of this study did not support highest degree obtained (e.g., doctoral versus nondoctoral) as contributing to greater accuracy of concussion knowledge score. Other
researchers (e.g., Bradley-Klug et al., 2013; Kahn et al., 2018) acknowledge the lack of communication and collaboration between systems and describe the need for increased service transition. In the absence of supportive collaboration and multidisciplinary cooperation between systems (i.e., medical and educational), children in need of support may not be tracked by medical or rehabilitation personnel, nor are they reported to schools for consultation and follow-up. Therefore, these students do not receive the appropriate adaptations, adjustments, or monitoring to improve recovery outcomes or mitigate detrimental secondary mTBI/concussion effects (Chesire et al., 2010).

Self-reported confidence was measured using a single question “Self-rank your knowledge about concussions” from (1) novice through (10) expert. This is the most commonly used method to examine school psychologists’ TBI confidence in training and skills (e.g., Canto et al., 2014; Davies et al., 2014; Hooper, 2006). Using this measure, participants (n= 179) demonstrated lower self-reported knowledge of concussions 56% fell between (1) novice through (5) neutral in comparison to higher knowledge questionnaire score. The discrepancy between higher and lower self-reported confidence may be due to how confidence was measured—one measure was asking to self-rank knowledge of concussions and the other asked participant how they would rate their level of knowledge pertaining to the recognition of concussions. In this case, these questions measured different qualities—confidence in knowledge and confidence in recognition. In this study, both are worthy of examination and contribute different and valuable information about working with mTBI/concussion students. In comparison to other studies measuring self-reported knowledge or training confidence, results from this study aligns with other research. Similar to speech pathologists (78%; Duff & Struck, 2015), 80% of school psychologists in this study reported not being confident in providing services to
mTBI students. For speech pathologists, this was attributed to feeling unprepared due to a lack of formal training.

Eftaxas and Canto (2020) found that even after 15 years of research, school psychologists continue to rank their knowledge (training and confidence in mTBI understanding) as inadequate when it comes to assisting children with head injuries. This not only demonstrates the value of self-reported competence measures in knowledge surveys, but also highlights the significance of competence as a mediator in the relationship between knowledge and training, as well as the impact of competence in the management of students with post-mTBI/concussion. More research is required to elucidate the complex relationships between calibration and accuracy, along with confidence and experience, in mild traumatic brain injury/concussion.

Research question one asked What is the current state of school psychologists’ knowledgeable of pediatric concussion/mTBI symptoms and outcomes? The mean TBI knowledge score for school psychologists was 14.89 (SD = 3.48) out of 21 total possible correct. Answering only about 71% of questions correct demonstrates a gap in knowledge. Items that school psychologist tended to answer correct (approx. 90%) included: “Traumatic Brain Injury is one of the classes of disability for which students are eligible to receive special education services under IDEA; Once a child is walking and talking normally after a TBI; There should be few, if any, aftereffects from the injury; A child must be unconscious after an accident for a TBI to have occurred; Slowed processing speed may be an aftereffect of a concussion; After a mild to moderate TBI, children may display symptoms of anxiety and depression.” School psychologist tended to answer incorrect (approx. 50%): “A stroke can be a form of TBI; Most traumatic brain injuries are considered mild; A child who is injured when s/he is very young should continue to develop in an emotionally and intellectually normal way; and Most concussions (mild TBIs)
resolve within 3 weeks of the injury.” Given this knowledge gap, the next research question sought to learn school psychologists do and do not obtain concussion-related information.

Research question two asked where (i.e., graduate coursework, supervised clinical experience, previous work experience, formal professional development, independent professional development) do school psychologists acquire concussion/mTBI knowledge? The school psychologist participants were asked to indicate “yes” or “no” to whether or not they had received education on concussion from five different sources. Of the 77% that did engage in formal concussion training, the participants most often reported the concussion training was obtained through years of experience as a school psychologist and independent professional development (e.g., reading of journal articles, books, chapters). Of these specific sources, majority of school psychologists (64.8%) reported independent continuing professional development. Approximately half (49%) referenced formal continuing professional development. Surprisingly, still fewer (27%) referenced training through supervised clinical experience (e.g., practicum, internship, post-doc) to provide services. Interestingly, approximately 77% of school psychologist endorsed an “other” category where there wasn’t a specific modality reference. Future studies should investigate what those modalities are.

Research question three asked how do school psychologists rate their competence to engage in of each step of a school-based concussion/mTBI management model? Research question 3 asked participants to rate their overall level of competence to engage in each step of a school-based concussion management model on a 5-point Likert scale. With respect to the modified version of Davies (2015) 7-step protocol, on average school psychologist did not report advanced competence (4) or exceptional competence (5) on any of the steps. Based on the roles and functions of school psychologists, one would expect at least minimal competence if not
higher across all of these activities. However, at least minimal competence (3) was only noted for Step 2 (Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication); Step 3 (Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment); and Step 5 (If no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs). These findings make as these actions are quite routine within the everyday activities of school psychologists.

With respect to each step, mean school psychologist competence ratings were lower than anticipated. When one reviews each of these steps, school psychologists would likely have some kind of experience with each of these activities, which would lead one to believe these averages would be higher. However, it is argued that because the actions were tied to concussion, school psychologists did not feel as confident. School psychologists are in a prime position to evaluate this student population in schools due to their extensive training in psychoeducational evaluation, which includes academic, cognitive, behavioral, and adaptive behavior assessment (NASP Practice Model, 2010). An important aspect of this multitiered system of support is communication. For students who have experienced a concussion, communication of information across stakeholders (e.g., student, caregivers, educators, medical professionals) is critical.

Surprisingly, school psychologist rated lower than minimal competence to engage in Step 1, Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI. Perhaps school psychologists are uncertain who to ask. Also interestingly, school psychologists felt the least confident engaging Item 4 “If no specific recommendations are available from a medical provider, conduct a symptom assessment to
determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.” This finding could possibly be understood in the findings of Eftaxas and Canto (2020) who found that school psychologists often felt that school nurses were in the best position to engage in school-based concussion management activities.

Consistent with the findings of Davies (2012) and Lung (2007), the results indicate that a general feeling of unpreparedness and inadequacy regarding the amount of graduate training in TBI assessment and intervention persists. However, school psychologists receive training in the areas of prevention, consultation, direct observation, and counseling. These skills may relate well to the types of assessments and competencies required to better serve concussion-affected students.

Research question four asked what factors (i.e., concussion/mTBI knowledge score, highest degree, years of experience, supervised clinical experience, previous work experience, formal professional development, independent professional development) predict school psychologists’ perceived competence to engage in each step of a school-based concussion management model?

**Step 1.** Interestingly, perceived competence to develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI is supported by concussion knowledge, some formal professional development and some supervised clinical experience.

**Step 2.** Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication is supported by concussion knowledge and highest degree. Notably, this was the only step that had highest degree as a contributing factor.
This could be because nondoctoral school psychologists don’t feel competent enough to initiate contact with families and the student.

**Step 3.** When looking at school psychologist’s perceived competence to use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment, supervised clinical experience dropped out but years of experience popped in, which could be because one gets more comfortable with documentation.

**Step 4.** If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.

**Step 5.** Concussion knowledge and formal professional development are factors that contribute to a school psychologist’s perceived competence to engage if no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs.

**Step 6.** It makes sense that years of experience would be predictive of being able to develop and distribute a written plan for adjusting the learning environment and academic expectations because school psychologists know how to write service plans.

**Step 7.** Concussion professional development, concussion knowledge, and years of experience are factors that contribute to school psychologist competence to identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required.
In general, concussion knowledge and formal professional development were reoccurring themes. It is apparent that knowing about concussions likely makes one more comfortable in working with concussions. Continuing professional development regarding concussions most likely would involves action steps which would increase ones perceived competence. You can have general knowledge about concussions, but that does not necessarily inform what you need to do about it. On the other hand, continuing professional development regarding concussions will likely include direct skills regarding what a school psychologists can do about it (i.e., action steps), which would explain why it accounts for the most variance. Generally, school psychologist did not feel competent to engage in the return-to-learn steps created by Davies (2016). This research shows increasing professional formal development can increase a school psychologists perceived competence to engage in any of the steps.

Research question 5 asked do school psychologists report having been involved in each of the steps of a school-based, concussion management model? Frequency counts were used to determine in which steps of a school-based concussion model (Davies, 2016) school psychologists had previously engaged. Most of the school psychologists (73.2%, $n = 131$) reported to engage in Step 3: Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment. Only about half (59.8%) of school psychologists indicated to engage in either Step 5 (e.g., if no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs), or Step 6 (e.g., develop and distribute a written plan for adjusting the learning environment and academic expectations). The least amount of school psychologists (32.4%, $n = 58$) reported to engage in Step 4: if no specific recommendations are available from a medical
provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive. Interestingly, developing and communicating a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI is the next to lowest percentage (33.5%) and can arguably be one of the easiest activities in which a school psychologist can engage.

While a medical professional must diagnose a concussion, a concussion is both a medical and an educational concern. Because concussions can lead to educational needs that may require school-based interventions and accommodations, school psychologists must be informed about concussion assessment procedures. A useful form from the CDC is the Acute Concussion Evaluation (ACE; Gioia & Collins, 2006) to help the school concussion team obtain information regarding the injury (e.g., severity, loss of consciousness, early signs; Davies, 2016). When a student sustains a concussion, school personnel can also utilize checklists to learn common signs and symptom. Davies (2016) discussed the Concussion Signs and Symptoms Checklist (CDC, 2015b) that can be used to assess and monitor observed signs (physical, cognitive, and emotional) if a student sustained a possible concussion both at school or if a student arrives to school reporting a possible head injury that occurred earlier or the previous day outside of school. At a minimum, school personnel can conduct ongoing evaluations of a student's concussion symptoms and monitor the effectiveness of academic adjustments.

School psychologists should be aware of BrainSTEPS programming. This program is designed to provide information and direct instruction regarding concussions and other head injuries, signs and symptoms of TBI, TBI/concussion teams in schools, and how to implement return-to-learn procedures (brainsteps.net). Current findings suggest that a professional
development experience based on BrainSTEPS would not only increase school psychologist knowledge of concussion and concussion management procedures, but also increase school psychologist confidence to manage concussion at school in general.

**Limitations and Future Studies**

Several limitations of the study should be considered before generalizing results to inform clinical practice. The researcher has limited knowledge of the psychometric properties of the concussion knowledge questionnaire used in this study. Future research using the Concussion/mTBI Knowledge Questionnaire should consider psychometric analyses (e.g., exploratory factor analysis, cluster analysis, internal consistency) to establish scale reliability. Additionally, due to the fact that not all school psychologists were able to complete the survey, coverage error due to inadequate representation of the target population must be taken into account. As a result, convenience sampling was employed, restricting the sample size and reducing the analytical power of a multiple regression investigation, hence limiting the generalizability of the conclusions beyond the sample.

It is reasonable to hypothesize that a school psychologist's perceived level of competence and awareness of practices will increase as their overall experience (measured in years of experience) increases. Weber and colleagues (2014) showed a substantial correlation between school nurses' years of experience and their knowledge of concussion-related adjustments, supporting this notion. Notably, these results may not always hold true; therefore, future research should investigate the association between years of experience and perceived competence. It is also plausible to assume that high levels of recent concussion experience, as compared to individuals with lower levels of recent experience, would reflect a greater familiarity with the effects of concussion and serve as a direct result for the number of students with concussion who
were treated (Davies et al., 2015). In other words, those who have dealt with concussed children will have a stronger understanding of the injury and its effect on concussion knowledge results. When treating recurrent concussions in children, these individuals will likely be able to draw from their previous experiences.

Hooper (2006) and Canto et al. (2014) found that school psychologists lack trust in their training and abilities (competence) to effectively work with concussed children. School psychologists continue to rank their abilities (training and confidence in TBI expertise) as inadequate for assisting children with brain injuries. Further study is required to clarify the complex relationships between previous experience and accuracy, along with confidence and experience, in mild traumatic brain injury/concussion.

Research continues to indicate considerable gaps in the training of school psychologist in how to help students with a TBI (Canto et al., 2014). This research is consistent with earlier studies that put forth the notion that professional development in concussion and TBI in general is a viable way to bridge these knowledge and skill gaps. Future research may wish to investigate the formal professional development trainings in order to have a better understanding of how to teach professionals in the field. Trainings might be comprehensive, focusing on pathophysiology, symptoms, prevention, communication, evaluation, and treatment, or they can be narrower, focusing on one or two of these topics putting most of the attention on applying a model in the field. In their examination of the effects of TBI-specific training on school psychologists, Davies and Ray (2014) discovered that the acquired knowledge and abilities were preserved for two months, but were lost over the one-year follow-up evaluation. It was believed that professional growth without continual practice, mentorship, feedback, or consultation was insufficient (Glang, Todis, Sublette, Brown, & Vaccaro, 2010). Davies and colleagues (2015) found that ongoing
assistance following initial professional development looks crucial for the implementation of effective SBCM trainings.

As previously referenced, school psychologist had to choose specific categories when answering research question 2. It is likely this research missed potential ways to learn concussion related information at work that was not specified in this study. Future research might conduct a focus group or ask open ended questions to learn what those sources may be.

Future research on this subject could elucidate the need for additional training in the various assessment procedures for concussions in children. As researchers continue to examine the knowledge and practices of school psychologists in mild traumatic brain injury (mTBI), there are a number of areas worthy of additional study. The continuing development of the school-based concussion management model is a crucial step in this endeavor. With additional reliability and validity studies (e.g., internal consistency, factor loadings), the school-based concussion management model could give useful information for practice, training, and research (academic curriculum, professional development workshops).

Lastly, as concussion management policies vary across the nation, additional research is required to compare provincial knowledge development and practices to determine the overall effectiveness of legislated protocols or approaches in managing children with mild traumatic brain injury (mTBI). In addition to examining the efficiency of student transitions, differences in student recovery processes and times, changes in student academic performance or support needs, changes in educators' service delivery and engagement (e.g., an increase in referrals or requests for consultation), and modifications in communication or consultation between stakeholders and educational professionals could also be examined. A detailed assessment of
delivery models that include and exclude school psychologists as service providers will aid in identifying the specific contributions school psychologists can offer to return-to-learn initiatives.
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Appendix A

Concussion Knowledge and Competency Self-Report Questionnaire

INCLUSION CRITERIA
Are you currently practicing?
   a) Yes
   b) No

Section 1:

DEMOGRAPHIC QUESTIONS
What gender do you most identify with?
   a) Male
   b) Female
   c) Gender Variant
   d) Other
   e) Prefer not to specify

What is your age?
   a) 20-24
   b) 25-35
   c) 36-45
   d) 46-59
   e) 60+
   f) Prefer not to say

What is your ethnicity
   1. Caucasian/Non-hispanic
   2. African American
   3. Native American
   4. Asian
   5. Hawaiian or Pacific Islander
   6. Hispanic or Latino/a
   7. Prefer not to say
   8. Other (please specify)

Which of the following best describes the community of the school you most commonly serve in your role in a school psychologist?
   a) Urban
   b) Rural
   c) Suburban
   d) Other

What is your highest degree earned in the field of school psychology?
   a) Masters or equivalent (MA/MS/MEd)
   b) Specialist level (EdS, CAS, CAGS, PsyS)
   c) Doctoral Level- PsyD
   d) Doctoral Level- PhD
   e) Doctoral Level -EdD
Other (please specify)

Practice Credentials?
   a) Credentialed School Psychologist
   b) Licensed to practice independent psychology

How many years have you worked as a School Psychologist (including full-time internship)?
   a) Exact Number

Approximately how many students with TBI have you worked with in a school setting?
   a) None (0)
   b) Few (1-5)
   c) Several (6-10)
   d) Many (>11)

Self-rank your knowledge about concussions: 1(Novice) – 10 (Expert)
   a) Exact Number

How would you rate your level of knowledge pertaining to the recognition of concussions?
1(Novice) – 10 (Expert)
   a) Exact Number

Section 2:

TBI Knowledge Questionnaire

Please respond to each statement to the best of your ability:

1. A concussion is a TBI (T/DK/F)
2. All head injuries are TBIs (T/DK/F)
3. Most damage caused by a TBI is apparent right away (T/DK/F)
4. Traumatic Brain Injury is one of the classes of disability for which students are eligible to receive special education services under IDEA (T/DK/F)
5. Once a child is walking and talking normally after a TBI, there should be few, if any, aftereffects from the injury (T/DK/F)
6. The amount of visible physical damage to the brain determines whether a TBI is classified as Mild, Moderate, or Severe (T/DK/F)
7. A stroke can be a form of TBI (T/DK/F)
8. A child must be unconscious after an accident for a TBI to have occurred (T/DK/F)
9. Most of the children who have had a TBI receive special education services (T/DK/F)
10. Most traumatic brain injuries are considered mild (T/DK/F)
11. A child who is injured when s/he is very young should continue to develop in an emotionally and intellectually normal way (T/DK/F)
12. If a child does not develop an emotional disorder one year after the TBI, s/he will not (T/DK/F)
13. If a child performs at normal levels post-TBI on cognitive tests, s/he will do just as well in school as before the injury (T/DK/F)
14. Slowed processing speed may be an aftereffect of a concussion (T/DK/F)
15. Depending on the severity of the TBI, a student may be at a greater risk for grade retention (T/DK/F)
16. After a mild to moderate TBI, children may display symptoms of anxiety and depression (T/DK/F)
17. Students should return to school and resume all normal activities after sustaining a TBI (T/DK/F)
18. Exerting strenuous cognitive or physical energy before symptoms are gone may lead to a worsening of symptoms. (T/DK/F)
19. Students who don’t allow time for cognitive rest may take longer to fully recover (T/DK/F)
20. Most concussions (mild TBIs) resolve within 3 weeks of the injury (T/DK/F)
21. Students who sustained a TBI are entitled to accommodations (via a 504 plan) when symptoms last less than 3 weeks, or modifications (IEP) when symptoms last longer. (T/DK/F)

Section 3:

For each of the sources of information, please indicate if you have acquired knowledge regarding TBI and return-to-learn protocols. Y/N
a) Years of experience as a school psychologist (categorical)
b) Supervised clinical experiences (e.g., practicum, internship, post-doc)
c) Formal continuing professional development activities (e.g., workshops)
d) Independent continuing professional development activities (e.g., reading of journal articles, books, chapters)
e) Previous job experience providing services to a child/student with a concussion

Section 4:

Experts report that a school district concussion management protocol should include at least 7 steps (Davies, 2015). Please rate your level of competence (knowledge and skills) to engage in each of the following steps.
1 – No competence
2 – Some competence
3 – Minimal standard of competence
4 – Advanced competence
5 – Exceptional competence

1. Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.
2. Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication.
3. Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment.
4. If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.
5. If no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs.
6. Develop and distribute a written plan for adjusting the learning environment and academic expectations.
7. Identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required.

Section 5:

Please indicate if you have engaged in this activity in your practice as a school psychologist in the past. Y/N

1. Develop and communicate a procedure to ensure the concussion team leader is notified that there is a student with a concussion/TBI.
2. Upon return to school, make initial contact with the student and family following a concussion/TBI to facilitate good communication.
3. Use documentation from medical professionals that may specify recommendation concerning restrictions from cognitive and physical activity, as well as recommended adjustments to the learning environment.
4. If no specific recommendations are available from a medical provider, conduct a symptom assessment to determine whether the concussed student will benefit from being at school, whether there should be a modified school day, or whether any attendance at school will be counterproductive.
5. If no recommendations are available, or if the recommendations are vague or no longer relevant due to rapid healing, assess the students’ academic needs.
6. Develop and distribute a written plan for adjusting the learning environment and academic expectations.
7. Identify an appropriate timeline for reassessment of needs to ensure that adjustments are not maintained for an unnecessary length of time or to determine if new adjustments are required.
Appendix B

Email To Participants

Dear Potential Participant,

I hope this email finds you well. My name is Braelyn Tracy, and I am a PhD student in the School Psychology program at Duquesne University. I am inviting you to participate in my dissertation research study examining school psychologists' knowledge of concussions and current practices regarding return-to-learn protocols.

The goal of this research is to better understand the current roles of the school psychologist in concussion management in schools. This study has been approved by the Duquesne Universities Institutional Review Board and is under the supervision of Dr. Ara Schmitt.

As such, I am seeking the participation of practicing school psychologist within a public school district. To reach you, I obtained your publicly available email address from your school system’s website. The survey will be administered electronically using an online platform and will take approximately **10 minutes** of your time. Participation is voluntary and completely anonymous.

Your participation is very important and may have implications for future training with concussion management protocols for school psychologists. Additionally, I kindly ask that you forward this message to other current practicing school psychologist. If you would like to participate, please use this link to complete the survey: LINK.

Thank you in advance for your time and consideration.

Best,

**Braelyn Tracy, M.S. Ed.**
PhD Student – School Psychology
Duquesne University
Tracyb1@duq.edu
Appendix C

Figure 1

Distribution of perceived knowledge variable

![Histogram of perceived knowledge variable](image)

Figure 2

Distribution of TBI knowledge score variable

![Histogram of TBI knowledge score variable](image)
Figure 3

Residuals Plot for the perceived knowledge variable