HIGH SCHOOL EDITION
Journal of Student Research
Volume 12 Issue 2 (2023)

Heading Towards Accountability: An Analysis of the Efficacy of Concussion Protocol

Lucy Rudolph[1], Van Schenck[#] and Missy Sullivan[#]

[1]First Colonial High School
[#]Advisor

ABSTRACT

The objective of this study was to evaluate the success of concussion protocols and accommodations, focusing on what factors were most influential. The approach will be a qualitative one, involving the use of open-ended questions and interviews to extract subjective responses. This approach was taken to encourage authentic answers and data. It concludes with an analysis of the data which reveals that while academic accommodations are beneficial, concussion protocols are not.

Introduction

Post-concussion syndrome: complex both in name and impact, and daunting to a 13 year old, which was the age the author was when they were diagnosed with it. Over the course of three years and three severe concussions, the author was left with debilitating concussive symptoms that would not dissipate. While neurologists could give a name for the condition, they could not provide a solution. Everyone was visited, from physical therapists to acupuncturists, and everything was tried from medication to nerve block injections in the author's face. It wasn't until four years after the first concussion that a last-resort surgical procedure finally relieved the pain. Although the author's problems were solved, there were still hundreds of kids who were not as fortunate.

Problem Statement

Many young athletes sustain concussions, yet oftentimes concussion protocols are not followed to properly treat those individuals. So, like with any injury, when a traumatic brain injury (TBI) goes untreated the symptoms worsen. The prolonging of these symptoms is referred to as post-concussion syndrome (PCS). While complete concussion prevention is unrealistic, it is reasonable to examine the shortcomings of the protocols put in place as a result. Current concussion protocols in youth sports fail to correctly address concussions in athletes, leading to the mishandling of concussionsions and prevalence of post-concussion syndrome in these young individuals.

Purpose Statement

The purpose of this study was to compare the experiences of several students who sustained concussions while in school to determine what, if any, flaws exist in current concussion protocol.

Research Questions and Hypotheses

The main research questions that were answered by this study, along with their corresponding hypotheses, are as follows:

Is concussion protocol in high school sports effective in managing concussions?

Hypothesis: Concussion protocols are not adequate in addressing traumatic brain injuries in adolescent athletes.

Are concussion accommodations sufficient for concussed students?

Hypothesis: Concussion accommodations are not sufficient for concussed students.

Definition of Key Terms

Nomenclature was used throughout this study, and the important words are defined below:

Traumatic brain injury (TBI)- An injury that results from a violent hit or jolt to the head.

Post-concussion syndrome (PCS)- Diagnosed when symptoms from a traumatic brain injury last longer than predicted.

Protocols- A set of rules that establish correct protocol and conduct for a given situation.

Debilitating concussive symptoms- Persistent physical and cognitive symptoms that impede on daily function.

Tinnitus- Persistent ringing in one or both ears.

Manifesting- To become apparent through the appearance of symptoms.

Skeletomuscular symptoms- Symptoms having to do with muscles, bones, and/or joints.

Subdural hematoma- A buildup of blood on the surface of the brain.

Vestibular dysfunction- A disturbance of the body's balance system due to injury to the vestibular system of the inner ear.

Research Aim and Approach

The goal of this study is to explore the success of concussion protocol in a large southeastern school system to determine if it is sufficient at responding to traumatic brain injuries (TBI) in order to prevent long term issues, such as post-concussion syndrome. The approach will be a qualitative one, involving the use of open-ended questions to extract subjective feedback. This approach is taken to encourage forthright responses about participants' experience with concussion procedure.

Symptoms

Post-concussion syndrome (PCS) occurs when concussive symptoms last longer than the predicted recovery time, which is typically somewhere between ten days and three months. PCS includes an array of both physical symptoms similar to that of a traumatic brain injury (TBI). These commonly include headaches, fatigue, dizziness, poor concentration, and slight memory loss. Similarly, many individuals experience sensory sensitivity, like tinnitus and light sensitivity. There are also numerous psychological symptoms that are often discounted. Difficulty regulating one's emotions is a characteristic of PCS, manifesting in the form of irritability and impulsivity. Cases of depression and anxiety are also becoming increasingly common with a PCS diagnosis. Additionally, in some cases of severe TBIs, these issues can be exacerbated by a neck injury that causes skeletomuscular symptoms (Serrano-Nevarro et al., 2022). Unlike with a typical concussion, with PCS these symptoms can last months without relief. During that time, old symptoms often give way to new ones, creating

a vicious cycle of overstimulation. For example, patients with whiplash may then experience muscular tension that causes chronic migraines which then lead to sensory aversions (Serrano-Nevarro et al., 2022).

Identification

There are no concrete tests to prove that a patient has post-concussion syndrome, like how strep throat can be detected with a swab. Rather, PCS is diagnosed when a set of symptoms, including headaches, memory issues, or fatigue, are present for long after a patient has sustained a brain injury. While computerized tomography (CT) and magnetic resonance imaging (MRI) can be helpful in uncovering severe structural damage to the brain, they cannot prove that someone suffers from a TBI or PCS (Mayo Clinic Staff, 2022).

Treatment

Post-concussion syndrome cases vary greatly due to the wide range of symptoms. As such, there is no single treatment but instead a plan tailored to each patient's specific needs. These plans are typically multidisciplinary, meaning they involve the use of both medications and therapies, and involve opinions from several specialties. For headaches and muscular pain, doctors typically turn to medication. However, this is not always an effective long term solution for those with PCS as the overuse of those drugs can actually cause more head pain (Mayo Clinic Staff, 2022). Antidepressant or antianxiety medications are also solutions for the psychiatric symptoms, like depression, anxiety and PTSD, but as a means to cope with the symptoms rather than cure them. Professionals assert that "symptoms often improve after people understand the cause of their symptoms and that symptoms will likely improve with time. Education can ease fears and bring peace of mind" (Mayo Clinic Staff, 2022). As such, psychotherapy is a valuable tool for many patients with mood disorders post-concussion. The other type of therapy that can prove useful for individuals is physical therapy. This can aid patients with muscular issues, like acute neck pain, recover their muscles. Similarly, vestibular rehabilitation is necessary for many people experiencing dizziness. The vestibular system affects balance and spatial perception. When this system becomes unbalanced, it can cause dizziness and balance problems (Cleveland Clinic, 2022). Physical therapy can help realign this imbalance. Unfortunately, not all symptoms can be treated. Issues with memory and cognition seem to get better only with time (Mayo Clinic Staff, 2022).

Misidentification

Trouble with identification by physicians is clearly one issue for PCS patients, however identification of the initial concussion is often another. Many young athletes rely on their coaches to follow concussion protocol after a suspected concussion to prevent further injury, however oftentimes coaches neglect this responsibility. One example of this is from 2013 when Rashaun Council (then 14) was playing in a football game at Monte Vista High School and sustained a concussion. Both he and a teammate notified the coaches; however, the staff ignored the concerns and allowed Council to finish the game. Neither the family nor medical personnel was alerted, and the coach did not follow any aspect of the school's concussion protocol. Later, Council was taken to the Emergency Department by his parents where he was diagnosed with a subdural hematoma that caused permanent brain damage. As exhibited by this story, the average high school concussion protocol is not strict.This can be attributed to a lack of resources, especially athletic trainers, and little guidance when creating procedures. A study published in 2020 analyzed these shortcomings by studying the protocols in several high schools in Pennsylvania. Researchers specifically compared the school authored procedures with state laws and physician recommendations. Through the study, they discovered that the most effective high school guidelines addressed Pennsylvania state law, included advice for injury prevention and post injury procedure, and included penalties for coaches who did not follow procedure. It also uncovered that schools with access to at least one

athletic trainer were more likely to identify concussions early on, as well as follow procedure (Beidler et al., 2022). This led to better and more timely treatment, and thus a quicker recovery. However, researchers noted that even in the most thorough protocols, there was no follow up for long term symptoms that would be indicative of post-concussion syndrome. This would include documentation of headaches, vestibular dysfunction, sensory sensitivity, and cognitive impairments following a concussion (Beidler et al., 2022). As anticipated, it was concluded that high school concussion protocols are inadequate. Pennsylvania is not alone in this, and it is an important component of PCS prevention that these protocols are updated. As demonstrated by the study, this is most effectively done through legal guidelines as well as dissemination of information about post-concussion syndrome.

Current Concussion and Accommodation Protocol

The Virginia Board of Education is mandated by law to develop and revise concussion protocol for a southeastern school district every two years. Historically, they have implemented what they call a "Recognize, Remove, Refer" policy. The "Recognize" component consists of education for coaches, teachers, students, and parents about general concussion symptoms, criteria for removal and return to sports, and the risks of not reporting a concussion (Va. Code §22.1-271.5). Currently, this information is disseminated through preseason parent-athlete meetings where an informational video is shown and a parent acknowledgment form must be signed. Additionally, a physical informational handout is sent home with all students at the beginning of the school year, and a resource page can be found on the school district website. The "Remove" factor of the protocol simply requires that any student who is suspected to have a concussion or has reported one must immediately be removed from play. Finally, the "Refer" aspect concentrates on ensuring that injured students have the proper resources to start their recovery. This requires that coaches report the injury to a child's parents as well as the school's Certified Athletic Trainer who will then perform an evaluation. The student must also visit the nurse upon return to school (Va. Code §22.1-271.5).

Additionally, in the protocol the Board of Education included return to school and play criteria. The school system requires that: personnel will be trained in concussion management in the academic setting with particular attention to the need for cognitive and physical rest. Appropriate school personnel will be informed of the student-athlete's injury and its specific symptom manifestations- physical, cognitive, emotional, sleep. An individualized plan will be developed and implemented to assist the student athlete's recovery. (Va. Code §22.1-271.5)

Simply put, teachers must know about any symptoms a student experiences and accommodate a gradual return based on physician recommendation. It is crucial that these symptoms are addressed as rushing recovery worsens physical symptoms, which damages a patient's psyche (Beidler et al., 2022).

Data Collection

The selected participants were all put through concussion protocol while attending a school in a southeastern Virginia school system. They were asked open-ended questions about who was involved in their recovery, how their symptoms impacted them, and prior concussion knowledge. The questions were as follows: 1) When you were diagnosed with your concussion, how did you get your diagnosis to your coach? 2) Can you describe what kinds of action were taken initially after you gave the report to your coach? 3) How did your concussion impact your ability to function at school? 4) Were your teachers alerted to the impacts of your concussion? 5) What in-school accommodations were offered to you as a result of your concussion? 6) What was the response from your teachers to any accommodations? 7) Did your accommodations meet the timeline of what your doctor predicted? 8) Do you feel that your accommodations gave you sufficient time to recuperate from your injury?

9) What kinds of education did you receive about concussions before you had one? 10) Do you feel that that education was sufficient in preparing you for your concussion?

The first and second questions were posed to discover what types of individuals were involved in students' recovery, such as teachers or athletic trainers. This addressed my first hypothesis that concussion protocols are not sufficient by learning about the professionals who were supposed to follow that protocol. The third, fifth, sixth, seventh, and eighth questions addressed the effect of symptoms on the participants and accommodations granted as a result. These questions related to my second hypothesis about the efficacy of academic accommodations by comparing students' needs with the help they ultimately received. Questions four, nine, and ten were designed to gauge the amount of concussion education provided, which corresponds with a component of concussion protocol in the school system.

Study Design

This study was a qualitative case study. Qualitative data collection occurred during one-on-one interviews to determine whether or not current concussion protocols and academic accommodations are successful at addressing concussed students' issues.

Population and Sample

In order to work with participants an Informed Consent Document was approved by the school system. The research was conducted at a large public high school in southeastern Virginia. The participants were selected by meeting three factors. First, they must have sustained a concussion while participating in a high school sport, even if it was not during a school-sponsored event. Second, athletes must have reported their concussion to their coach, and finally, currently be over the age of 18. All participants were assigned pseudonyms.

Qualitative Research Design

Qualitative data was organized systematically in order to report findings from interviews in a logical manner. The design, procedures, traditions, paradigm, researcher's role, data collection, data analysis, and ethics of the study will be discussed following this paragraph.

The qualitative component was designed as a case study with the students in the experimental group as the case. In order for this to be considered a case, it was bounded and researched for a period of time (Hays & Singh, 2012). The students in this case study were bound by the geographical area, the school, the course, the teacher, and the time of day the course was offered. The purpose of this case study was to determine if concussion protocols and accommodations are effective in addressing concussion in student athletes. Though the idea of case study itself is challenging (Hays & Sing, 2012), the researcher created the design with the following in mind: 1) the researcher recorded interviews and made sure to ask follow up questions which were flexible and unbiased; 2) the researcher followed proper qualitative protocol (structured interviews, field notes, careful storage, record management, etc.); and 3) potential case study ideas were researched thoroughly before being used in data collection (Yin, 2003). The case in this study was categorized as a collective case study since the purpose of the study was to take multiple cases, the students and their views of the goal valuation intervention, in order to investigate a phenomenon of this particular population (Stake, 2005). Participants' answers to interview questions were analyzed in order to determine if there was a commonality among answers.

The qualitative component was designed as a grounded theory study. In order for this to be considered a grounded theory case, hypotheses are tested, data is collected and analyzed, and a theory is developed, which is *grounded* in the data (Chun Tie, Y., Birks, M., & Francis, K., 2019). Data collection consists of observations

and interviews, and the data is recorded through handwritten notes and tape recordings (Chun Tie, Y., Birks, M., & Francis, K., 2019). Constant comparison, also known as coding, is used to group the participants' answers into themes to allow new adjustments and interpretations to the theory (Chun Tie, Y., Birks, M., & Francis, K., 2019).

Qualitative Research Paradigm

The research paradigm is the way in which the researcher will conceptualize the philosophy of the research question to be addressed in the study (Hays & Sing, 2012). The tradition of this case study was a positivism paradigm since the researcher "arrived at an objective universal truth through direct observation and experience of phenomena" (Hays & Sing, 2012, pg. 39). It was the goal to use empirical research in order to make meaning of how students reacted to the experience of the intervention (Patton, 2002). For this to happen boundaries were set between researcher and participants, avoiding outside discussion, and using statistical procedures to control variables as much as possible (Galuzzo, Hilldurp, Hayes, & Erford, 2008). The researcher further followed the precedent of positivism by establishing a treatment and control group with randomized sampling procedures, defining terms of the study, and objectively measuring responses to the intervention (Hays & Sing, 2012).

The relationship forged between the researcher and the participants allowed for engagement in authentic and critical research methods (Hays & Singh, 2012). This kind of engagement was essential in order for the researcher to gain a deeper understanding of the participants' knowledge systems (Hays & Singh, 2012). Yin (2012) suggested that in order for the research to describe authentic learning and meaning the researcher must implement methods that allow for closeness to the case. This relationship between the researcher and participants allowed for genuine discourse, in turn leading to more authentic data (Paris, 2011). This authenticity was reflected in the answers given by the participants.

Role of the Researcher

The researcher is a white, upper middle class female who is a student at the southeastern school system that the participants attended. The researcher has interacted with the majority of the participants in school, and interacted with the others only over the phone.

Qualitative Data Collection

In order to collect qualitative data, the researcher had to coordinate a separate time and place to meet with five subjects. Since the interview is the case study's most important source (Yin, 2014), it was important to make sure the interviews occurred in a non-threatening environment.

Before students entered the site the researcher had to: 1) identify where the participants would be interviewed; 2) have permission to use the site; 3) plan how the interview would happen at the site; 4) decide the length of time each student would be at the site; and 4) predict what might go wrong at the site (Hays & Singh, 2014).

Four participants were interviewed over the phone and one was conducted in person in a quiet classroom. Before the interview began, participants were greeted and the interview process and purpose was reexplained. Any concerns about the informed consent form were addressed as well. Once both parties were better acquainted, the researcher began asking ten prepared questions, getting clarification when needed. Upon completion of the interview, the researcher would ask the participant if he or she had any other questions and once answered, the participant would exit the field (Hays & Singh, 2014).

Qualitative Instruments

Semi-structured interview protocol. One-on-one interviews totaled approximately 25-35 minutes per student, and consisted of approximately ten questions. These questions were based on both state law and school system requirements for concussion protocol in order for students to detail their experiences with that protocol. For example, the researcher wanted to evaluate current accommodations, so participants were asked about their symptoms and any help they received for those symptoms. Additionally, the researcher asked clarifying questions which pertained to the individual participants' answers. Questions included, but were not limited to, topics such as injury timeline and accommodation examples. This interview protocol was developed by the researcher for use in this study.

Qualitative Data Cleaning

Qualitative data needed to be addressed in order to have data that could be easily understood. According to Yin (2014), questions for case studies need to remind the researcher of the information that needs to be collected. Each interview question was created in order to collect the necessary information to address the research question. The researcher analyzed answers in order to address qualitative inquiry.

Qualitative Analysis

Qualitative data was collected during five individual interviews in which participants were asked questions to address the following overarching inquiries: 1) Is concussion protocol sufficient at responding to concussions in youth sports in a southeastern school system? 2) Are academic accommodations in a southeastern school system sufficient at addressing the needs of concussed students? Interviews lasted approximately 25-35 minutes, and participants' responses were recorded with a digital recording device. Interviews were then transcribed and patterns were derived to create a code book, themes, and subthemes. This process was repeated with all interviews until all themes and ideas were identified.

The overarching concept of this study was to evaluate the strength of concussion protocols and accommodations for adolescent athletes. Through participant responses, three major themes emerged: 1) reporting student injury to coaches, 2) role of academic accommodations, 3) success of concussion education.

In the following section, each theme will be detailed along with the sub themes that developed from the data. The section begins with the theme of reporting student injury to coaches. Four sub themes developed from this: 1) immediate removal from play by coach, 2) non-response by coach, 3) method of referral to Certified Athletic Trainer by coach, 4) success of Certified Athletic Trainer. The second theme that emerged was the role of academic accommodations, which revealed the subthemes: 1) sensory processing difficulties, 2) cognitive impairment, 3) efficacy of accommodations. The final theme from the data was success of concussion education, which shaped two sub themes: 1) student levels of prior concussion education, 2) effect of concussion education on athlete.

Reporting Student Injury to Coaches

From this theme, four sub themes appeared: immediate removal from play by coach, non-response by coach, method of referral to Certified Athletic Trainer, and success of Certified Athletic Trainer. The overall theme corresponds with the "Remove" and "Refer" strands of protocol as participants discussed how coaches reacted to their injury, including if they were taken out of play.

Immediate Response by Coach

Participants were questioned about the actions that their coaches took immediately once informed that the athlete had sustained a concussion. In accordance with both state law and school board concussion protocol, four students, Harry, Liam, Niall, and Zayn, were immediately removed from both practice and games. Liam described that "at first, I was just like sitting out and kind of watching." As athletes and their physicians deemed ready, they were allowed to reintegrate back into low-impact activity. Zayn noted that "I just like sat [out.] I still went to practice, um, cuz I just like being there cuz it was fun, and I would just sit out." These interactions exemplify correct adherence to concussion protocol.

One athlete, Louis, had multiple concussions while participating in a school sport. However, he detailed how he was rarely removed from play once coaches were made aware. He discussed that coaches would allow him to continue to play, so he sought outside help by visiting "the concussion doctor a couple times, a few times." After informing both his coaches and teachers, he was met with little concern. He recalled that " if you had a concussion you just kind of, you still go to class and you still get treated the same as everybody else."

Method of referral to Certified Athletic Trainer by coach

Following district guidelines, two of the students, Liam and Niall, were referred to their school's Certified Athletic Trainer by their coaches. Liam recalled that after reporting his concussion, "[My coaches] had me like sit out for a while and then they had me go see the trainer guy and he would like check up on my pain, balance, and stuff." Niall had a similar experience where he was pulled from play and instructed "to like go see the athletic trainer and like wait until [the trainer] told me I could play again." In addition, Zayn and Louis eventually made contact with the trainer, but were referred by teammates rather than coaches. Zayn stated that "I was like telling my friend [about the symptoms] and she was like "oh you might have [a concussion]" so I went to [the trainer] and I told him and he was like "yeah you have one."' Finally, one athlete, Harry, was never sent to the athletic trainer. When questioned about reintegrating into play, he described how "I mean I was still having problems like headaches and stuff, but when it became soccer season for school I think I just went [and] like played. I don't think I did anything [with the trainer] or like my coaches did anything."

Success of Certified Athletic Trainer

The students that were sent to the trainer experienced varying levels of success in recovery. One trend that appeared was success in diagnosing and treating short-term symptoms. Niall and Liam reported that the activities completed with the trainer, including biking and jogging, allowed them to prepare to reintegrate into their sport. Zayn noted that "I don't even think I would have known that I had a concussion if it wasn't for him, because you know a lot of people didn't like, don't believe me that I had one 'till I went to him." However, all students reported that the trainer was unsuccessful in treating their long-term issues. These individuals expressed experiencing headaches, brain fog, and balance issues even after being cleared by the trainer to return to play. Niall reflected that "I guess it was like hard because I still had headaches but they just didn't seem to go away even when he told me I could play again." Several of these athletes, Niall, Zayn, and Harry (although he did not see the trainer) attended physical therapy through an outside source to try and cope with their symptoms. After several months, the students reported that their symptoms had diminished due to the activities done in physical therapy.

Role of academic Accommodations

Three sub themes stem from this topic: sensory symptoms, cognitive impairment, and efficacy of accommodations. A significant part of the recovery process of concussions is the slow integration back to school, which often requires altercations to students' workload. As such, the Virginia Board of Education requires that schools allow for academic accommodations to help reduce injured students' symptom triggers while maximizing the

amount of instruction they receive. During the interviews, participants were questioned about their experiences with any of these symptoms and how they were impacted at school. All but one of the interviewees were granted academic accommodations as a result of their issues, and those individuals discussed the impact of the accommodations.

Sensory Processing Difficulties

One struggle reported by interviewees was increased sensory sensitivity that impaired their ability to function properly at school. Specifically, many participants faced increased light sensitivity. Harry, an athlete, reported that "when I went back to school I wore sunglasses for the first maybe couple days… because like being on the computer really hurt my head." Additionally, many individuals experienced hearing sensitivity and occasionally tinnitus. One student, Zayn, noted that they "remember sitting in my science teacher's room during lunch because it was too loud and she would have to like turn the lights down." These sensitivities made it extremely difficult for students to collaborate with peers as well as participate in normal classroom and social activities.

Another common occurrence was increased absences due to headaches. While physicians recommend to refrain from attending school for a few days after a TBI is sustained, interviewees missed numerous days past that and as a result, missed valuable instructional time. Zayn shared, "I definitely remember missing certain days just because like because my head hurt too much and… I just like missed out on school which sucked."

A combination of these symptoms was also common. Liam explained that "mainly the worst part was just like headaches from the bright lights. I felt way more tired at school, um, and the loudness was giving me headaches a lot so it was mainly just the headaches were making it harder for me to work and focus in class."

Students who experienced these physical symptoms had very similar accommodation plans, and reported allowances to minimize exposure to negative stimuli. In response to his light sensitivity, Harry "turned [assignments] in on paper for definitely the first like couple months just because using a computer hurt." Similarly, Zayn's accommodations allowed him to sit out in the quiet hallway during classes if the light was irritating, and to eat lunch in a dark classroom due to the high volume of the cafeteria.

These athletes also utilized their accommodation plans for a much shorter time than their peers with cognitive symptoms. Interviewees reported that their sensory limitations resolved within several months, and that they were able to return to normal participation at that time.

Cognitive Impairment

Along with sensory issues, several participants experienced cognitive impairment, which impacted their ability to fully engage in instruction. Louis discussed how he experienced brain fog following his TBI, stating: "I mean while I had a concussion, yeah I didn't feel myself definitely felt foggy. I don't know, I would actually, I could say that it could have affected my attention span like I feel like I developed like some sort of ADHD, like very mild but like I'd take, you know, my tests definitely slower".

Liam described a similar struggle, specifically addressing memory issues that made it difficult to retain and recall information. He noted that "I also had memory problems so I was having difficulty, like, remembering things, and doing bad on tests."

Unlike the athletes with only sensory symptoms, these individuals' symptoms were yet to subside at the time of the interview, years after their initial TBIs. As a result, their accommodation plans took the form of 504 Plans, which allow for long term allowances. Some of the unique accommodations factored in the time missed for appointments and physical rest days. Liam shared, "I had excused absences if I had like headaches or doctor's appointments."

The mental delays these students experienced also made it difficult for them to focus and produce work for an entire school day. Each 504 allowed for extended assignment deadlines and some excused work. Additionally, due to memory issues, participants had difficulty retaining information and required extended tests. Niall discussed these, saying "I can take breaks during school and… I [can] take private testing." Similarly to

sensory accommodations, the 504 plans worked to eliminate overwhelming stimulus so that patients would not over exceed their abilities and worsen their symptoms.

Efficacy of Accommodations

Two factors emerged that influenced the efficacy of the accommodation plans. The first was that the proper symptoms were addressed for the proper amount of time. Out of the athletes that received plans, all reported that their accommodations met the timeline of their recovery. Niall expanded on this, saying "Having the extra time on tests definitely did help and it like definitely improved my grades."

The second factor was teachers' willingness to implement the plans. In all cases, teachers were diligent in ensuring that students were given all the help they needed to recover. Teachers were frequently described as "understanding", and Niall mentioned that "most of the teachers were like really understanding like and a lot of them like have asked liked [to] help and offered to help which is good." Students also discussed how the open communication between teachers and their students allowed them to focus on recovery rather than managing deadlines. Zayn commented on this, saying that "they were all like really accommodating and I remember cuz all the teachers and stuff were really close and like they all knew all the students, and, just really well so they were all just really chill about it and like whatever you need just do it."

Success of Concussion Education

The final topic athletes were questioned about was their knowledge of concussions prior to their own TBI, and how that education prepared them for their injury. This aligns with the "Recognize" and return to play factors of protocol which state that students, parents, and school staff must be aware of the physical and mental effects of a concussion. The subthemes of student levels of prior concussion education and effect of concussion education on athlete grew from this.

Student and Teacher Levels of Prior Concussion Education

Niall, Liam, Zayn, and Harry all reported a low level of concussion knowledge prior to their TBI through their physical education class or school sports team. Three of the individuals mentioned that a short video was played during a pre-season meeting, but could not recall any specific details or information about its contents. Similarly, Zayn described a brief disclaimer, saying "we had a meeting when I started cheer like the first year and they mentioned [concussions] and that was kind of it." One student, Louis, reported no concussion education. When asked how much knowledge he had about concussions he stated, "I don't know, like probably none. I guess maybe, yeah, they would tell you like "hey you might get a concussion" when you signed up to play but other than that nobody really talked about it."

In addition to their own concussion knowledge, students also discussed their teachers' awareness of TBIs. Several participants agreed that while teachers were very compliant with their accommodations, teachers were not fully familiar with the symptoms that would warrant those plans. When questioned if teachers understood the need for a 504 plan, Niall reflected: "Not really it was just kind of like I have a concussion here's like, [they] were just giving my 504." When asked the same question, Louis responded with a definitive "not at all."

Effect of Concussion Education on Athlete

Regardless of education level, all participants did not feel that they had adequate knowledge to prepare themselves for their injury. Specifically, they noted that while they anticipated having a headache, they were not prepared for the other symptoms. This made it difficult for some to even identify their concussion. Niall commented that "I didn't even know I had one until I talked to the trainer… they kind of told us that you would have a headache or whatever but that was kind of it." Additionally, the athletes were not expecting the presence of cognitive impairment and sensory sensitivity, and as a result did not know how to cope with them on a day

to day basis. This made it increasingly difficult to reintegrate back into school. Liam touched on this, commenting: "I didn't really know what to expect with the headaches and memory stuff, I didn't realize that was going to happen so I'm glad I had those accommodations to help." Finally, the duration of the symptoms caught many athletes off guard. While the trainer was able to help manage some short term issues, such as balance problems, students were not expecting their symptoms to last for months at a time. When describing feeling unprepared, Zayn said that he did not know that he would "have to go to therapy, um, physical therapy for [his symptoms], um. And like the headaches lasting more than two weeks." Harry made a similar comment, saying "I knew I would have a headache because I had like other teammates who that, who had had that, but didn't know that I would have like light sensitivity or or that the headaches would be that bad and like last for so long."

Discussion

The objective of this grounded theory study was to analyze the success of concussion protocol and accommodations in a southeastern Virginia school system.

Research Question One: Is concussion protocol in school sports [in the southeastern school system] effective in managing concussions? The hypothesis was: Concussion protocols are not adequate in addressing TBIs in adolescent athletes. This hypothesis was founded as the "Recognize, Remove, Refer" policy is insufficient to help athletes. The "Recognize" component relies on concussion awareness through education provided by the school. All participants, whether they had received concussion education or not, reported that they did not have the proper knowledge to prepare for their injury and faced emotional struggles as a result. It was also reported that although teachers were compliant with accommodations, they were not previously aware of how concussion symptoms create the need for those plans. Furthermore, not all players were immediately removed from play, violating the "Remove" requirement. Finally, Certified Athletic Trainer involvement as part of the "Refer" aspect was inconsistent. Out of the participants that consulted the ATC, only two were sent by their coach and all individuals reported that the trainer was unable to address their long term symptoms. The data reveals that the concussion protocol in the southeast school system does not appropriately educate the proper parties about traumatic brain injuries, leading to lackadaisical adherence to guidelines and subsequent failure at treating injured athletes. Participant responses indicate that the solution to this shortcoming is to provide more comprehensive concussion education in order to motivate coaches to follow protocol in order to prevent post-concussion syndrome. This would also ensure that students are both prepared for their symptoms, and provided accommodations during recovery. Ultimately, this would reduce the emotional damage inflicted.

Research Question Two: Are concussion accommodations [at a southeastern school system] sufficient for concussed students? The hypothesis was: Concussion accommodations [in the system] are not sufficient for concussed students. The researcher found that concussion accommodations are successful at aiding injured students. Although not all participants received accommodations, that failure does not reflect on the efficacy of the plans but instead on coaches and ATCs, who are responsible for reporting an injury. Participant responses highlighted that both temporary and long term accommodation plans allowed them to minimize the amount of symptoms they experienced at school, while also staying up to date on instruction.

Limitations

Threats to internal validity include selection of subjects. The overall population was composed of only five subjects as the researcher had to locate and contact subjects that met stringent criteria within a limited period of time.

One threat to external validity to be considered is population validity as the students who participated in the study were from a very specific location. Ecological validity is considered since these students are from

a certain population in a large school system. Due to this threat findings can only be generalized to a specific population. To address this threat, the setting was controlled as much as possible. Subjects were made comfortable by selecting the time and location of their interview. Nonthreatening language was also used throughout the interactions and the researcher encouraged clarifying inquiry.

Acknowledgments

I would first like to thank Mrs. Van Schenck, my Legal Research and Writing and Senior Project teacher, for her patience and support. She gave me the confidence to take on this daunting task. I would also like to thank my Senior Project advisor, Dr. Missy Sullivan, for showing me the ropes. Although her schedule was packed, she took the time to teach me the qualitative research process and ensure that my final product was the best it could be. Finally, I would like to thank my parents. They were always there to bounce ideas off of and encourage me when I got frustrated. Without them I would not have healed from my injuries enough to conduct this study.

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