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Ncaa Division-I Student Athletes' Lived Experiences of An in-Season Concussion

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NCAA DIVISION-I STUDENT ATHLETES' LIVED EXPERIENCES OF AN IN-SEASON CONCUSSION

by

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(Under the Direction of Thomas Buckley)

ABSTRACT

An estimated 1.6-3.8 million people suffer a concussion annually in the United States. Concussions are becoming an increasingly mainstream topic, especially with the amount coverage of concussions in different media outlets. Furthermore, peers such as athletic trainers, friends, coaches, and parents that may influence their experience of concussions. The purpose of this study was to examine NCAA Division I student-athletes' lived experiences of an in-season concussion. A phenomenological approach was used. The following open-ended question was asked: "Can you tell me about your experience of having your most recent concussion?" The research participants consisted of 4 in-season collegiate student-athletes, 18-21 years old. The participants were withheld from activity per the institution's concussion policy and interviewed within six months of their return-to-play. Interviews were tape-recorded, transcribed, and analyzed. Pseudonyms were used to ensure participant anonymity and confidentiality. The researcher used triangulation to maintain validity by using member checks, peer reviews, other members of the research team, a bracketing interview. 6 major themes developed from the research including: Focus on Symptoms, Emotional Response to Injury, Experiences of Concussion Testing, Fear of Failing to Meet Teammate Expectations, Support From Friends and Family, and Effect on School. Emotional Response to Injury and Symptoms

were the most prevalent themes with their experiences following suit with previous research. Some participants seemed to struggle with schoolwork, which supports the cognitive rest theories that are currently being used to help treat concussions in some areas. Overall concussions are very individualized injuries and athletic trainers should be aware of athletes' personalities and use compassion to help them recover from their concussion.

INDEX WORDS: Concussion, Lived Experience, Student-Athlete, Athletic Trainer

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TABLE OF CONTENTS

Page

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

An estimated 1.6-3.8 million people suffer a concussion annually in the United States.[1] Concussions are becoming more of a mainstream topic, especially with the increased coverage of concussions in different media outlets.[2,3] This coverage, ranging from opinions to published research, makes it very easy for athletes to develop their own opinions on concussions, potentially affecting their individual experience of a concussion. Beyond media coverage, the student-athletes' athletic trainers, friends, coaches, and parents may influence their experience of concussions as well.[4,5] Previous literature has focused on measurable data such as physical, cognitive, and emotional symptoms, physiological responses of the body, as well as issuing recommendations on return to play.[6-12] However, there are very few studies examining aspects of a concussion from the student-athlete's point of view. Having an understanding of the student-athlete's perspective may provide athletic trainers a better picture of what student-athletes experience and how they deal with being required to sit out of competition.

Previous literature has suggested injured athletes follow a similar emotional response to the Kübler-Ross theory of death and dying, in which a person experiences five stages of grief in the following order: denial, anger, bargaining, depression, and acceptance.[13,14] However, recent research now suggests injured athletes do not follow a prescribed set series of emotions. Many injured athletes experience multiple stages at once or may revert back to a previously experienced stage.[13] It now appears there are three general categories of emotional response to injury. These are injury-relevant information processing (focusing on information related to pain, cause, etc.), emotional upheaval and reactive behavior (emotional responses to being injured), and positive outlook and coping (acceptance and optimism).[13] This makes for a much more

individualized response to injuries, supporting the need to examine individual experiences of sport-related injuries, including concussions.

There have been quantitative studies focusing on emotional symptoms. For example, Hutchison et al. and Mainwaring et al. examined the difference in emotional symptoms between concussed participants and those with ACL injuries. They found that athletes with concussions were more likely to have a greater mood disturbance, increased fatigue, and decreased vigor. Depression was also elevated in the concussion group when compared to the control group suggesting depression may be a symptom of concussions.[6,15] However, emotional symptoms are just one part of what forms a student-athlete's experience of a concussion.

Sharing individual experiences of injuries, including concussions, seem occurring more frequently. With the rise of Internet usage in the 2000's and the more recent social networking outlets, information and personal experiences are made available to the public more frequently. Two of the most popular social networking websites, Facebook and Twitter, both may be used to discuss athletes' personal experiences about their concussions or on the topic in general. In two recent studies, "relating personal experiences" ranked as one of the top ways to discuss concussions via social networks. One of the respondents stated, "Feel free to share any experiences or advice you may have for someone with a brain injury or for family and friends of that person." Additionally these sites are also used to ask questions about their own concussions and how to treat one.[2,3] The availability of this material may affect the experience an athlete has while having a concussion. Athletes are not only receiving information from social media but potentially from coaches as well.

A 2011 study investigating the knowledge of Idaho high school football coaches found that 34.7% of coaches still believed a mild concussion did not warrant immediate removal from a

game or practice,[16] which is lower than a 2007 study that found about 60% of youth coaches believed the same thing.[17] These findings are supported by a 2009 article which reported that 79% of high school coaches did not know proper management procedures for a concussion, although 92% can recognize when a concussion occurs.[18] One coach, in the Idaho study, supported these statistics by stating, "In my opinion and experience as a player and a coach, every player experiences at least one of the [concussion] symptoms…at least once a game and practice. Where to draw the line between a real head injury and getting your bell rung is tough."[16] This coach appears to think that "bell-ringers" are not concussions and therefore do not need to have the concussion policies/procedures implemented. Indeed, nearly half of youth coaches in 2007 (49.4%) endorsed the misconception that an athlete must experience loss of consciousness to have a concussion.[17] One way to know if a coach's misconceptions affect an athlete's lived experience is to interview athletes one on one and listen to their personal perspectives.

While a post-concussion phenomenological study has not been published, a recent editorial on concussion management has delved into the lived experience of a concussion, focusing on the societal aspect of junior ice hockey concussions.[5] Conducting eight case studies, the author interviewed post-concussion individuals who were suffering from prolonged periods of concussion symptoms. There were several themes that resulted from these interviews, the most prevalent of which was the feeling of frustration from concussions being an invisible injury. A comment by one participant epitomized this theme explaining, "For the most part friends and other outsiders do not see my injury like they would a broken leg; it's an invisible injury. Friends may make comments…" The literature supports this statement suggesting one of the top reasons (27%) athletes do not tell anyone about concussion symptoms is not wanting to

let their teammates down.[19] Additionally, about 27% of high school rugby athletes in New Zealand reported that their teammates should play through concussion symptoms if it is an important game.[20] An abstract by Kroshus and Kroshus suggested that male collegiate hockey players only reported their symptoms after they realized they were not going away.[21] Several other themes appeared in the post-concussion editorial as well such as a feeling of denial, isolation, and the presence of stress.[5] In addition to interviewing the athletes, Echlin interviewed parents and coaches of youth hockey players who experienced concussions as well.

Parents seemed to play a major role in determining whether athletes should play through a concussion, often disregarding recommendations from physicians to not play.[5] At least several parents and coaches in the editorial resisted the diagnoses of concussions and, in some cases, even allowing the evaluation of concussions to take place. One parent of an athlete who had sustained a concussion stated, "I know my son and he seemed like himself at breakfast, so I see no reason why he should not be out there at practice." Conversely, quantitative literature found about 95% of New Zealand rugby parents would not let their children return to play if they had a concussion, however, only about 50% were aware of existing guidelines or protocols.[22] Additionally, prior to the beginning of a season one of the coaches in the Echlin editorial explained that he did not want anyone else making personnel or medical decisions, even when it comes to a concussion. As a result, athletes in both of these instances may have continued to play through their concussions, putting them at risk for second impact syndrome.[5] If a coach is telling an athlete to remain in the game, while parents/athletic trainer/team physician recommend sitting out (per the institutions return to play protocol), a potential internal conflict may arise. Ultimately, this editorial supports the need for a phenomenological study investigating the athletes' lived experience of a concussion.

Quantitative aspects of concussions have been extensively examined in the literature; however, the student-athletes' prospective of their injury has gone mostly unstudied. Knowing the athletes' individual lived experience of a concussion may give direction for future concussion research. Therefore, the purpose of this study was to examine NCAA division I student-athletes' lived experience of receiving an in-season concussion.

A phenomenological approach was used to ascertain these responses as it seeks to describe the meaning of lived experience about a concept or phenomenon.[23] The goal of a phenomenological study is to eliminate biases and prejudgments to ascertain a person's lived experience exactly how it was perceived.[24] Four participants were asked a single question, in which they will tell the author about their lived experience of having a concussion. Each interview was transcribed, irrelevant and repetitive words (such as umm and ah) were eliminated, and then common themes were gathered from the interviews. [25,26]

CHAPTER 2

METHODS

PARTICIPANTS

All participants in this study were NCAA Division I student-athletes and who had experienced an in-season concussion. The inclusion criteria were as follows: each student-athlete was 18-21 years old, experienced an in-season concussion within six months of the interview, diagnosed with a concussion by their team physician, and completed the institution specific return to participation protocol. Additionally, exclusion criteria were as follows: the student athletes experienced their first concussion of the season, had not experienced a repeat concussion that season, and otherwise injury free at the time of their interview. The participant selection process involved contacting each potential participant in person to explain the purpose and content of the study. Pseudonyms were used for their names to protect their identity: Participant 1 is referred to as Jack, Participant 2 as George, Participant 3 as Sally, and Participant 4 as Lisa. Additionally, any information shared with the research team was kept confidential and was not reported to a participant's athletic trainer, team physician, coaches, or teammates. Participants also signed an informed consent form stating they were aware of the procedures, risks, and purpose of the study.

There were 2 males and 2 females, with ages ranging from 18 to 21. Jack and George both played football, Sally played tennis, and Lisa was on the swim team. This was each participant's first diagnosed concussion and everyone was currently active in their sports at the time of their interview. None had missed time since they returned to participation from their concussion. Jack's concussion occurred while making a tackle in a game. George's concussion occurred during a road game. He was on the kick off team and tackled somebody, however did

not report the concussion. The athletic trainers discovered the concussion at the end of the game. Sally's concussion occurred during a practice. She swung her tennis racket at the ball and let go with one of her hands, allowing the racket to hit her in the head. She finished practice and went in to see the athletic trainer for an unrelated injury. The athletic trainer noticed a bruise on her head and began concussion evaluation. Lisa's concussion occurred during weights when she dropped a weight on her head. She was briefly unconscious and teammates reported the injury immediately.

There were 18 concussions available before inclusion and exclusion criteria were considered. During this process one concussion was eliminated because he was on the team the lead investigator worked with, one concussion was eliminated due to the student-athlete leaving school, two concussions were not disclosed to the research team, three concussions occurred out of season, and seven concussions were repeat concussions. Following this process, the four participants left all agreed to participate in this study.

All four participants made or were expected to make significant contributions to their respective teams during the season. Jack was a Junior; the other three participants were Freshman. In Sally's case, she missed an invite only tournament in which her and a teammate had been the only two invited from their school.

It is important to note that the primary investigator (PI) was a Certified Athletic Trainer at the same institutions the participants compete. The PI and the participants did not know each other personally prior to the interviews, however, the possibility of the participants being familiar with the PI from seeing them in the facilities cannot be ruled out. This may lead to bias due to the participants wanting to withhold information regardless of the confidentiality agreement.

PROCEDURE

All interviews took place within six months of return-to-participation and occurred in the Georgia Southern University Sports Psychology Laboratory to help ensure confidentiality. The time between injury and interview has varied in previous research between a few weeks and up to a year;[27,28] therefore the six month window was based on an estimated average from the previous literature. Prior to each interview, the participants were reminded the interview would be recorded to ensure accuracy of the transcripts, copies of the transcripts were provided to them, the transcripts were then read by the entire research team to identify themes, and pseudonyms were used to ensure anonymity.

The research team consisted of one graduate assistant and three faculty members. Two members of the research team were athletic trainers and have extensive knowledge of sport-related concussions. A third member had training in the field of athletic training and sport related injuries. The lead investigator kept a code sheet of the pseudonyms for the purpose of returning the transcripts to the participants.

INTERVIEW PROTOCOL

This study used an existential phenomenological approach as it sought to describe an individual's lived experience of phenomenon.[23] The interview began with a single open-ended statement to facilitate the participant's exploration of their experience in relation to a concussion.[25] The following statement was presented to each participant: "When you think about your most recent concussion, can you tell me about it?"

Additional interview questions were based off the participant's responses. The interviewer made every effort not to lead the participants, thus limiting researcher bias. Interviews lasted between 12 and 40 minutes.

DATA ANALYSIS

Data for this study was analyzed by adopting a procedure developed by Czech et al. and Patton,[25,26] which includes four steps.

1. Approaching the interviews
    - *Transcribing the interview*
    - *Obtaining a grasp of the interview*
2. Focusing the Data
    - *Bracketing the data*
3. Phenomenological reduction
    - *Eliminating irrelevant, repetitive, or overlapping data*
    - *Verifying the elimination of the data*
4. Releasing meanings
    - *Forming categories*
    - *Identifying the themes*
    - *Describing the themes*

Approaching the Interviews

Transcription. The first step was to transcribe the interviews verbatim. This was contracted to an outside source by the lead researcher. No participant names were in any of the

recordings to ensure anonymity. All transcriptions were read and re-read by the research team to ensure accuracy.

Obtaining a grasp of the interview. The data was read and listened to two times, allowing the research team to account for and document any emphasis put on certain words or phrases. Additionally, this allowed the researcher to truly understand the athlete's experience of a concussion.

Focusing the data

Bracketing the data. After the data was transcribed, it was bracketed. Bracketing the data identified any biases the researcher may have. An awareness and mindset where created in which, "all elements and perspectives [have] equal weight."[26] This means everything the researcher associates with the topic was presented in the discussion. This process is unlikely to eliminate biases the reader may have, therefore the purpose is to make the reader aware of the researcher's biases when they are reading the analyzed data.

Phenomenological Reduction

Eliminating irrelevant, repetitive, or overlapping data. This step was used to eliminate any irrelevant or repetitive such as meaningless utterances. Examples include "um" and "uh" and was done in a way as to not lose the meaning of the participants experience but to allow for a smaller and more manageable transcript.[25]

Verifying the elimination of the data. Two weeks following the interviews, transcripts were provided to the participants via email to assure no meaning of their lived experience had been lost. The participants read their respective transcripts to ensure accuracy. All participants approved their respective transcripts.

Releasing Meanings

Forming categories. During phenomenological reduction, overlapping themes were removed, making the data clearer. This was done by forming 'meaning units', or "a segment of text that is comprehensible by itself and contains one idea, episode or piece of information."[26] These meaning units were then grouped into clusters consisting of different themes formed throughout the transcription. An expert in phenomenological research was included in this step to ensure limiting bias.

Identifying themes. Each interview was then looked at individually to identify themes. The themes retrieved from each interview were compared to each other to identify the "global themes", which was coded into categories and given labels that capture the substance of the interviews.[25]

Describing Themes. Results of qualitative data were presented by a) focusing and balancing the data, and b) describing and interpreting the data.[26] After irrelevant data was omitted, the description and interpretation of the data highlighted what was common across the athletes' experiences. Thus, capturing the essence of the phenomena.

Reliability

According to Patton, in order for a qualitative study to be reliable, one must consider the participants trustworthiness.[26] During the course of this study, four questions helped make this data reliable;[25,29] 1) Do the descriptions capture the experience? 2) Do the transcripts match the participant's experience? 3) Does the structure emerge from the data? 4) Do others see the description? Therefore, if the descriptions of the student-athletes' lived experience of a concussion are true (we assume the athlete is telling the truth), then the study is considered reliable.

Validity

A study's validity is based on the reader's ability to experience the descriptions presented to them as truthful (the actual experience of the participant).[25] Triangulation was used in this study to maintain validity. Triangulation provides a mixture of sources to converge on particular phenomena from which the conclusions may then be drawn.[26] This study used member checks (participant reviews), peer debriefers, the research team, and a bracketing interview. Member checks allow the participant to ensure the meaning of his experience was maintained throughout the analysis. The peer debriefer was an expert on phenomenological methodology and a part of the research team. This person reviewed the transcripts to ensure the correct themes are being drawn. The research team was used as outside perspectives and viewpoints on transcripts, as well as to come up with an unbiased approach after the bracketing interview.

Bracketing Interview

Concussions are injuries that are becoming a very popular and sensitive subject in the media and throughout the sports world. From my experiences with a concussion, coaches can often times disagree with the initial diagnosis of a concussion, especially if the injury is to a starter or they will miss a lot of practice/games. Coaches also see it as more of a problem in season as opposed to out of season. Concussion return to play typically lasts around 10-14 days, depending on how long the symptoms last. Athletes sometimes resist the diagnosis and do not want to be held out but I think they mostly understand why they are being held out. From my experience they eventually seem to accept the diagnosis, but can push their limits on what they are allowed to do, like how much they can do at practices. I do not see much interaction between teammates regarding concussion and from my experiences some may be supportive and some me

not agree with the decision for an athlete to be held out. They often times seem to understand it is better for the athlete with the concussion to sit though. I have never been diagnosed with a concussion or missed time from athletic competition due to having a concussion. I have read a lot of research and am very well versed in the known facts and epidemiology regarding concussions such as common symptoms, known physiological differences in the brain, and concussion testing procedures.

I have diagnosed 2 concussions in my career. If an athlete gets hit in the head or they report symptoms of a concussion to me, I ask them basic memory and orientation questions such as “Do you remember what happened?” and “Do you know how much time is left in the game/where we are playing?” I will ask them to count backward from 100 by 7 to test their concentration and will ask them what, if any symptoms they are experiencing. If they report they are suffering symptoms or appear to have memory/orientation problems then I will pull them from activity immediately and refer them to the team physician for evaluation. I then follow the designated concussion policy for my school.

CHAPTER 3

RESULTS

Overall there were six major themes developed from the four participants' experiences: Focus on Symptoms, Emotional Response to Injury, Experiences of Concussion Testing, Fear of Failing to Meet Teammate Expectations, Support from Friends and Family, and Effect on School. Additionally, the Emotional Response to Injury theme had five sub-themes present. All of the themes are inter-related to each other. Figure 1 represents the six themes and how they interact with each other.

Emotional Response to Injury

The most prevalent theme (based upon how often the theme was discussed) that developed during analysis was the participants' emotional response to their injuries. This refers to how they viewed and dealt with their concussions throughout their recovery process. Five sub-themes developed out of this theme: Injury Relevant Information Processing, Emotional Upheaval & Reactive Behavior, Denial, Acceptance, and Frustration with Injury.

Injury Relevant Information Processing

This sub-theme included any reference to the participant speaking of the cause of the concussion or any pain associated with it. Sally seems to have been impacted by this theme the most, discussing her cause of injury multiple times:

> "The last tie-break that we played, I just knocked myself in the face and then we all were like laughing and everyone saw that I was laughing and, and I may be stopped for five minutes, just like laughing at myself"

"I mean, it's just funny now. It doesn't bother me anymore but I mean, even at the time it was funny that day even, I couldn't believe that I'd whacked myself in the face, after they told me I couldn't travel, I wouldn't have laughed if someone gave me a hard time about it but that weekend, they were like, "Wait, wait, I thought you were supposed to be in Florida?" And I was like, "Oh, I was suppose to be," xyz, this happened and everyone would laugh and at that point, I was just like, I'm just going to have to roll with it because there's no hiding from it. It's not embarrassing that I got a concussion. It's just embarrassing how I gave myself one."

"There was a huge knot on my forehead and it hurt, my head hurt all over but I just didn't think that I had given myself a concussion."

The other participants all briefly spoke of their cause of injury or pain. Jack focused more on both aspects saying:

"I took a good direct blow straight to the head, then I got hit the same way with my head collision to the ground so it was double impact and when I got up, I thought I was fine."

"It's just so intense and it happened so fast that you don't have time to react, get your body prepared for it, prepare it for some sort of impact. So when you're not prepared for stuff and it hits you all the sudden, you don't know how to react to it. Your body don't know how to react to it."

"It was pretty painful"

Lisa followed suit by first explaining how the concussion happened, "I was lying on my back with the weight above my head and for some reason, I thought that if I dropped it, it'd go

around my head but instead, they just landed straight on top of it," and "Well [I felt] really retarded. I don't know why I thought they wouldn't fall on my head but they did and it hurt a lot." Conversely, George only mentioned the cause of injury when he said, "I think it happened at one of the kickoffs, I had head to head contact with one of the players and then I fell, got up, spun around, and made a tackle."

Emotional Upheaval & Reactive Behavior

This sub-theme represents any of the participants' experiences that represent how they dealt with their concussion emotionally. The two female participants represent the vast majority of this sub-theme. Sally's experience seems to have been very emotional. She starts by explaining how embarrassed she was about how she received her concussion. She remarked, "It was super embarrassing," "I was so embarrassed," "I'd been training really hard for [the tournament] and then I just, hit myself in the face with a racket. It was just so embarrassing," and "It was so embarrassing and then I just continued to play."

She then turns her focus on how mad and upset she was at having a concussion and with the fact she could no longer travel to a tournament. She states:

> "I think I was just so emotional just because I just wanted to go so badly to the tournament, I didn't want to believe that like, I'm not a football player so I just didn't understand how I could have a concussion and how they were telling me I couldn't travel and that it was going to be a couple of weeks before I could even practice again or workout, anything"

> "I didn't care if anyone saw me [crying]. I was so, so angry that they were telling me that I couldn't travel, I even lied, I said, "I have to go to the bathroom," and I ran outside to

call our coach, thinking that she could help the situation to say it wasn't as bad as it was. Yeah, I didn't care. I was acting like a baby in front of everyone and I was fine with it because I wanted it my way and they weren't going to budge."

"Just the whole process was frustrating. Being told I couldn't go to the tournament was frustrating, having to wait so long to practice is frustrating, the headaches themselves were frustrating, like I had really bad headaches and so the whole concussion was a frustrating time period"

She further enhances these thoughts during the interview by giving a slight laugh, seemingly in disgust, nearly every time she is talking about her anger or being upset. Lisa differed in how she showed her emotion in that she was more upset than mad. She mentions crying frequently in her recount of her experiences:

"I never, ever, ever cry unless something really, really affects me and for me to be told that I've come all the way to America and I can't now swim out here, I was devastated. I didn't know what to do with myself because it's what my parents were paying all this money for me to be here and swim and now I wasn't going to be swimming and I kind of felt like I really let myself down and I was really stupid."

"I just didn't care that anyone saw me cry, I was upset. I wasn't going to hide it. Swimming is my life; being told I can't do it was awful.

Lisa also explained that she was very upset with herself and with the situation by saying, "It was kind of a really stupid thing to think that weights are going to go around your head when

gravity obviously takes them straight down and I tend to do really stupid things every now and again and just, I was annoyed with myself that I saw that. Like, I'm not retarded…"

The male participants' experiences were much different. Their anger was not the primary focus of their experience and unlike the female participants, they did not cry while when they were first diagnosed with a concussion. Jack simply said, "Just the feeling, the feeling of not knowing where you are and the, the pain, just the pain that comes all the sudden, one minute you're fine and the next minute, you feel like you're on a stretcher, it's a terrible feeling." George contrasts this by expressing some anger when he says:

> "But, right, I felt bad that I wasn't going to play. I remember I was just mad that I wasn't able to play but now I know this was a great decision that I didn't do that."

Denial

Three of the participants seemed to be in denial at one point during their experience. Jack expressed this by saying, "I thought I was fine but the athletic trainer seen that I wasn't and he pulled me out and it just was, just weird, just a weird feeling." George expressed his denial in a similar fashion saying, "At the time, I told him I was fine and then I remember hearing him keep on coming there checking on me and then that's how I knew I was in bad shape," and "At the time I felt like he was just bothering me because I felt off but I couldn't put together how bad a shape I was so I kept telling him, 'I'm alright. I'm alright. Go on, I'm good' but they could tell that there was something wrong." Sally expressed similar feelings of denial at least 6 times during her interview.

Acceptance

All four participants went through an acceptance stage was although it was expressed in different ways. The male participants focused on their realization that the athletic trainers had held them out for a reason:

> "You know, the football field you have to think positive. And me, personally, I took it as, maybe it was just a good shot, just a good blow to the head but it turned out to be a concussion and so, me saying that I couldn't react the way I could, I had to think, next time I won't be ready either so it was a good call on the athletic trainer and I'm glad they did it. And I think it'll help me out in the long run." *(Jack)*

> "I know now that it was best that I didn't play that week because I needed to get my mind, my brain, to try and heal and recover before I try to get back into action so I just felt more that I had to take the test because the little test was a pain in the butt." *(George)*

For the female participants it seemed to take a specific moment in their experience to accept their concussion. This came for Sally when she realized she would not travel. She said:

> "Well, after I had calmed down and realized that I probably did have a concussion at that point…And then the next, probably the next night, I was like, "Alright, well I'm not traveling. That's not even a question anymore. There's just something wrong with my head," and so I just started noticing [symptoms]."

For Lisa, acceptance came following an accident she had on her bicycle. She explained:

> "I kind of realized I had actually hurt myself and that even though I got told I couldn't—that was, when I crashed, I realized I needed to actually listen to the trainers and when they say, 'Don't do exercise,' they mean it, because they're not stupid. Like, that was

what made me realize I needed to listen. Because before then, my athletic trainer said, 'Don't, whatever you do, cycle,' and I was like, 'I'll be fine,' and I did it and then I crashed."

Frustration with Injury

Three of the four participants expressed frustration with their injury in some form, with the females expressing more than the males. George said:

"I mean you just didn't feel right like you couldn't practice, you couldn't run around, you had to take tests all the time, you had people constantly asking you questions like how you feeling and everything and I was just not used to having people checking up on me all the time and it was like I'd just rather be just playing besides feeling like I was just injured because it was hard to feel injured I had nothing to show for it."

Sally's frustration stemmed from her drive to want to compete in her tournaments:

"Our last tournament of the season was…a pretty frustrating game. I was cleared to play but only on the last day because my time frame was the last day we were there, I could play but I went exhibition on that Sunday, but I mean, I hadn't practiced in like three weeks so and I'm a perfectionist, so its hard going on the court, like knowing, you haven't practiced in three weeks and you're missing shots that you know you can make but this whole concussion has kept you out and now you're losing to a girl you can probably beat."

Finally, Lisa mentions two sources of her frustration, one from not being able to work out and the other from some of her teammates:

> "They said I'd have at least one week off if everything went as planned and then, one week off in swimming is equivalent to like two or three weeks, you lose your fitness and you have to catch up like two or three weeks and so I didn't want to be behind in the beginning of the season and playing catch up on everybody else. I joined really fast and then when I started, I didn't do really well and then I thought, 'This is really bad,' yeah, didn't think I'd get back into it but I kept on going, I got it…I can't even describe it, I was just really, really upset. I didn't know what to do with myself, so the coaches told me I didn't have to come to practice every day and just watch and I was like, 'Well, what else am I going to do?'"

> "I wanted to hit [my teammates] really hard, like, tell them what I was really going through but then I knew it wouldn't really get me anywhere and then, I just decided that I'd show them when I got back in the pool so I did."

Focus on Symptoms

All four participants discussed experiencing headaches at least once in their interviews, however explained them differently. Jack explained it as, "sharp pain from my neck up, scream headache—from dead on, that whole weekend I had a scream headache," whereas George simply said, "My head was hurting." The female athletes had much more rich descriptions with participant three explaining:

> "I hit myself on my forehead; it was always a lot of pressure around my eyes. I guess, that's what it was, like, just in that sense, it was just so much pressure towards my forehead and it just felt like it was all over—my whole brain just felt like it was about to explode." *(Sally)*

> "Then I had a consistent headache. It was really hard to fall asleep at night, laying down put a lot of pressure on my head and then in turn like sitting up—it was just, it just felt like a lot of pressure all the time." *(Sally)*

> "Well, I did the elliptical and while and I was doing it I'd feel okay and then I'd get back down poolside, because, after I'd do it, I'd go and watch everyone and I'd get back down to poolside and then like my head would just start pounding, like really pounding. Then I'd like have to sit on the floor and just hold my head. And I felt like if I held it, it really felt like I was holding my head together and then, I would take pain killers and it'd just go away. That was like my first week, it kept doing that." *(Lisa)*

In addition to experiencing headaches, other symptoms were experienced as well, but were more individualized. Jack indicated he experienced multiple symptoms, including nausea, lightheadedness, and a lack of awareness:

> "They asked me what quarter I was in, I was not sure about, I was kind of hesitant about it. I asked him what had happened, what did I just do, I couldn't respond"

> "I was kind of woozy, a lot of woozy, a strong headache that it kind of had this little spinner like I had just was on a merry-go-round about a thousand times and I stopped"

George stated he was experiencing some of these same symptoms when he said, "I felt a little dizzy," and "I wasn't feeling fatigue but I felt nauseous." It was clear he felt a few other symptoms as well but mainly focused on his lacking sense of awareness at the time of the injury:

> "I was just staring out into space. I remember everybody telling me I had the blankest look on my face and then I remember—I wasn't even thinking about anything, 20

minutes probably passed without a thought going through my head. And I sat there and I was staring out in space. And I remember I went to sleep and I woke up and then I started feeling a little better but then I felt like there was something that had happened."

Sally noticed similar symptoms to George, commenting about memory loss, sensitivity to light and sound. Sally also noted anxiety and irritability, but no nausea:

"I was nervous and I didn't know why they were asking me all these things and I was so irritated with these things, which was probably another sign I had a concussion."

"Just like all these little tiny things that normally wouldn't have bothered me were just really bothering me and then the more questions they asked, and the more I thought I was getting questions wrong, I just getting more and more irritable."

Lisa did not really discuss the presence of symptoms other than her headache, however did explain having a loss of consciousness (the only participant to experience this) and what appears to be post-traumatic amnesia immediately following her injury. She stated:

"Well, I got hit in the head because I dropped a weight on it and then I was out for like two seconds, and then I got taken to the sports room downstairs and then they asked me a load of questions—I really don't remember much of that."

"I didn't really know about this until I got told afterwards—my friend said that they'd say my name over again and I wasn't responding and then I started responding. So that's when they said I was out for a bit—because my friend just watched me do it and she'd realized what I'd done"

Participants' symptom severity was also noted with all participants. Although briefly, three of the participants described some varying degree as to how bad their symptoms were. Jack simply stated, "The pain was intense. On a scale of one to ten, it had to be a 20…" In contrast, George focused more on his recovery of symptoms and how he improved each day. He explained:

> "Tuesday, I just felt like clear, it felt like when the coaches were talking to me, everything was just clear, not all the way but by Wednesday and Thursday it was like I was walking through a fog and then I started walking closer and closer out of the fog as the days went on. And by Saturday, I remember at the game, I was feeling good. I didn't really feel like how I felt on Monday. On Monday, I still felt kind of bad. I just felt like my head was hurting. My head was hurting and I just couldn't concentrate, I just didn't feel the same, you know, you just don't feel right."

Sally spoke more on making sure she was honest and detailed in describing the severity of her symptoms to the athletic trainer. She explained:

> "It was really bad headaches and stuff the first couple of days after doing it and then probably, it wasn't bad but still something wrong but I didn't know that saying "One," even if it was like a tiny headache was going to keep me out of practice so for awhile, it was not like significant pain, significant sensitivity to light or irritability or anything like that. There was just a little bit so I thought they needed to know if—and they do—they needed to know exactly, what, how bad it was until I gave honest answers all the way up until it was completely gone."

> "Every day I would go in there and they would say, we would do the zero to five and I was just giving honest answers thinking if I was just getting better than I would be able to practice—not knowing that everything had to be a zero before I could practice again. So then they'd be like, "How's your headache?" And I'd be like, "Like a two." And they'd be like, "How sensitive are you to light?" I'd be like, "One," so it didn't matter if it was not a whole lot, it had to be zero and it's probably good that they didn't tell me because I probably would have just been like, "Zero, zero, zero," all the way down."

Experiences of Concussion Testing

All of the participants included their experiences of concussion testing in one form or another. This included computerized tests and non-computerized tests. For Jack explained, "They asked me a couple of questions and told me to start count, subtract seven from 100. And I did until 93. After 93, everything just went blank and they asked me another series of questions like how did I run the ball, which side did I run to," and "Then they told me to walk on straight line and I was wobbling like I had been intoxicated or something."

Sally further elaborated on their experiences with non-computerized tests, including how she was feeling while performing each test:

> "And she started giving me tests and they were the hardest tests ever, like, they would read off a series of numbers and then I'd have repeat them backwards like as many as I could get, that's hard to do anyway. And they would tell me starting from 100, count down by seven…They were just, I just thought they were, I mean, I don't know if it was because I had a concussion why they were so hard or if, I mean, I had to do tests for a couple weeks after and it was the same test. They would name so many words or

whatever and then I would have to name back in the same order as many as I could remember and I was like, this was so ridiculous, because I thought it was so hard."

"I knew I was getting them wrong because there was lists like a few of the numbers and first they would be easy, it would be like four numbers and so I would easily repeat those four backwards and then they would just keep adding numbers on and so the more I would try to remember what the first couple numbers were, I'd already forgotten—and I wasn't event listening at that point, to the last couple of numbers just being named so then I just didn't have a shot in the dark. I knew I was not doing as well as I needed to be."

Lisa primarily focused on one specific non-computerized test:

"Then I had to do this walking test, which took like 20 minutes and I had to walk up and down this line…"

I had to do balance testing where I'd stand on one leg on the floor and then I'd stand on the same leg again on a foam and they would count how many times I fell over or off the one leg. And then I would have to walk up and down this straight path thing and that was like measuring where my foot was placed, where my feet where placed, and where—apparently the first time I did, the day I got my concussion, apparently I walked all over the place, which was like, "Yeah, you have a concussion." And I had to do that every day."

Participants' experiences of concussion testing also involved the computerized neuropsychological test. Sally's account of taking the computerized neuropsychological test centers around her ability to travel following the test. She recalls:

> "Then they wanted me to take the [computerized neuropsychological] test and I still was like, 'I don't understand why I'm doing all this,' and then the head trainer said, 'Listen, you didn't pass the test. You're not playing this weekend'"

George and Lisa not only explain the test, but talk about how they felt they were doing and what they felt like following the tests:

> "They made me take that concussion test and they told me I couldn't do anything so I just remember spending most of the time before I got down here, taking a little test on a computer. I did really bad. I did really, really bad. My reaction time went up like a second; it was crazy."*(George)*

> "I think, it was the test on the computer helped me explain [what I mean by walking out of the fog]. On Monday, I did really bad. On Tuesday, I was doing a little better. On Thursday—no—I took it on Monday, Tuesday, Wednesday. For example, I did good on that. So on Monday, I did really bad. On Tuesday, I did a little better. On Wednesday, I was almost at normal but I was still under, and then by Thursday afternoon, I passed the test, so I was relieved that I passed the test" *(George)*

> "I had to perform online quiz questions with symbols, which, they showed me a load of symbols and then I had to say which symbols I saw. And then I did the symbols test on the computer, about three times?" *(Lisa)*

> "Even during the [computerized neuropsychological] test, I was nervous and I was alone in the room but I knew that I needed to be doing these questions right and I had a feeling that I was missing them so…" *(Lisa)*

Fear of Failing to Meet Teammate Expectations

Three of the four participants experience feelings of fear when trying to meet teammate expectations. Jack, George, and Lisa state at least once that they did not want to let their teammates down. However, all seemed to be for different reasons. Jack focused on his own performance by saying:

> "When I step on the field, I have to—I can't think about me anymore, I think about my teammates. I can't let my teammates down. I can't let my team down and the team include the athletic trainers, the football players, the fans, and if I'm not at my peak performance, I don't think I'm mentally ready"

George felt he was not fulfilling his role on the team by expressing:

> "The concussion happened halfway through the game and I played the rest of it. At the end I told everybody I had it. You don't want to seem like you're soft or nothing because you're not supposed to get concussions. So I told them and then when I got on the bus, all I was thinking about was just playing next week because it was a big deal, so I was thinking about the game."

> "I just felt like—I don't know why I felt like I was letting them down but I really did. I felt like I wasn't like performing like they were because I wasn't able to play in the game."

Finally, Lisa felt she couldn't make up her lost time in the pool, although later realizing that she wasn't as behind as she thought. She stated:

> "Our next meet was four weeks away so I was thinking I was going to be three weeks behind if I had one week off. And then, I just thought that I'd let down the team because they had such high expectations for me, if I had one week off, then, I was going to be affected but I could catch up on it and then three weeks off, I was like, I have no chance of picking up where everyone else has got to, so then I was like, that's a good way of thinking. It won't make you better, you've got to do better so then I was just like, 'I'll try harder whenever I get in the pool.' And then it didn't affect my season, really. If anything, I actually kind of felt better when I got in."

Support from Friends and Family

Three of the participants mentioned positive support that they were receiving either from their teammates or their parents. George focused on his teammates by saying, "I remember, one of the linebackers, I play linebacker, we're around each other so much, we can tell when there's something off so I was sitting there and then he came up to me and asked me was I okay?" Lisa also received support from teammates:

> "Then my two friends looked after me and fed me that night. They all just stayed in and everyone was really supportive so it kind of helped"

Sally and Lisa focused on her parents, explaining:

> "Yeah, I mean, [my parents] were obviously really concerned because they're not in college with me so there was nothing they could do about it. They were listening to me, obviously and just saying, 'Hopefully, it's nothing,' but they just assumed, just went

ahead and chatted with the trainer and said that something was wrong. I was just trying; I was just calling them, thinking, just trying to" *(Sally)*

"My mom ended up just leaving [with me] and I think we went somewhere to go eat or something just to get away from all the noise." *(Sally)*

"My mom and dad called up that night, making sure I was okay even though it was like three in the morning for them. They still called up and then I felt sad and then some girls on the team came over and everyone brought me presents and flowers and cake. And then like every practice, people would come up and say, 'Hi,' and tell me I'm not missing out on anything. And then, my big (an upper classman on her team), she was really, really supportive. She was always there if I got upset, she would just come over and just sit there. Just the team and the coaches were just really, really, really nice, like they understood." *(Lisa)*

Effect on School

The final theme that developed from the student-athletes' experiences was the effect on school that the participants experienced because of their concussion. George and Sally both had school negatively affected from their experience. Sally stated, "It was just, it was hard being in class, trying to take notes." George went into much more detail regarding the affect his concussion had on his schooling by saying:

"I remember being in psychology and we took our test online and I think we had a test a week or something like that so I just noticed that at the end of the season, like at the end of the school year that my test grades around that injury time went down. I was making 90s. I was making 95, 92, 86 and then my grades went to 77 or 73 or 70 and then I started

> making 80s and 90s again and I could tell that it was around that time like maybe—I don't know if, just like, I wasn't able to think about the questions or something like that."
>
> "[Test grades were down for] about three weeks…I really felt that maybe getting a concussion really had something to do with it because, I mean, I just felt like I honestly was doing my best and then I think that those three weeks kept me from getting an 'A' in the class, so I think it kept me to like an 86 or something like that in class"

Conversely, Lisa's schoolwork was unaffected by her concussion, "I never really got any homework last semester and I did it in study hall in 20 minutes I think for the rest of the time. So when they said I don't have to be [at practice]…I had nothing else to do."

CHAPTER 4

DISCUSSION

This study is one of the first to provide a first-person account of student-athletes' experiences of concussions. Six themes were found in the analysis of these interviews: focus on symptoms, experiences of concussion testing, fear of failing to meet teammate expectations, support from friends and family, and effect on school. These results show the four participant's experiences to be highly individualized, further supporting the idea that no two concussions are the same.[30]

The most prevalent theme that developed throughout the analysis was the emotional response to injury. Each of the participant's in this study had different emotional responses which did not follow the Kübler-Ross five stages of grief in order.[14] In fact, at least one of the participants did not appear to exhibit all five stages of grief (Jack did not report experiencing depression). Previous literature supports these findings by suggesting there are three general categories of emotional response to injury that everyone may move through differently: injury relevant information processing (referring to cause of injury and pain), emotional upheaval and reactive behavior (how the patient responds emotionally to the injury), and positive outlook and coping.[13] Two of the most common stages of grief experienced were denial and acceptance, however they were not experienced in the same order that the Kübler-Ross theory would have predicted.[14] Instead, in most cases, they experienced anger and denial first, followed quickly by acceptance. The participants never seemed to let go of their anger, particularly Sally, until their return to play occurred. This contrasts what the Kübler-Ross theory suggests and supports newer research suggesting these stages are experienced interchangeably (occasionally at the same time) and there is no set order that emotions occur in.[13,14]

One theme that was discussed multiple times by all of the participants was their experiences of the concussion testing protocols. The primary tests that were mentioned by the participants were Standardized Assessment of Concussion (SAC) and the computerized neuropsychological test. The SAC test is widely used and consists of asking questions addressing immediate memory, delayed memory, awareness of surroundings, and concentration.[30,31] The test consists of a series of questions and exercises addressing immediate memory, delayed recall, concentration and reaction time.[30,32] The main focus of the participants' experiences were centered on the assigned task during the tests and the level of difficulty involved. Jack compared his balancing test to being intoxicated while the other three participants expressed frustration for how difficult all of the tests were. An interesting finding was how much the participants thought their return to play (RTP) was based upon passing the tests. However, passing the tests is just one aspect of making a RTP decision. Another aspect is the presence of symptoms and how long they last.[30,33]

Participants' focus on their symptoms was another emerging theme among the data. The three most common symptoms of a concussion tend to be headache, dizziness, and confusion. Headache tends to be the single most commonly reported symptom in the literature occurring in 85.2-93.6% of all concussions.[7,8,11,34] These trends were confirmed among all four participants. Loss of consciousness may be one of the most well known symptoms of a concussion. However, it is very rare (3.9-8.9%)[7,9,35] its presence is thought to have little effect on the outcome of the injury.[33,34] Of the four experiences that were examined in this study, only Lisa experienced loss of consciousness and she said it was very brief (probably less than 30 seconds). She was thought to have been experiencing a concussion right away, however, the other participants' were less obvious.

Neither Jack or George reported their concussion until the end of their respective game; Sally did not report hers because she did not think she had a concussion and the athletic trainer eventually noticed it. McCrea et al. reported that 52.7% of high school football players do not report concussions to anyone. The second and third largest reasons for not wanting to report their concussions included not wanting to leave the game (41%) and not knowing they had a concussion (36.1%).[19] The three participants in this study that failed to report their concussions used these two reasons when examining their experiences.

The prolonged presence of symptoms (average of six days)[11] and the potential brain dysfunction may account for the effect the participants' concussions had on their schoolwork. Three of the participants discussed, at least briefly, their experience with school while having a concussion. George and Sally focused on the difficulty they had, while Lisa said her schoolwork was not affected. There is no known research on how concussions affect student-athletes' schoolwork, however, current literature suggests using cognitive rest when treating concussions.[9,11,33] Cognitive rest refers to refraining from critical thinking or use of the brain that may result in the increase of symptom severity. This may include taking exams, heavy concentration in subjects such as math, and the use of computers.[36] Based on the comments given by participants, a longer period of cognitive rest may be warranted for some post-concussion cases. Furthermore, Giza and Hovda found neurometabolic problems in the brains of mice lasting up to 10 days.[37]

The results from this study also show varying degrees of emotional responses to concussions. This supports current literature showing that concussion patients do experience an increase in emotional symptoms and depression following injury. Hutchison et al. and Mainwaring et al. found concussed athletes experience greater mood disturbances and depression

than with ACL injuries. They went on to suggest that the depression experienced might have been caused by the concussion.[6,15] Anger seemed to be a major part of two of the participants' experiences. This seems to conflict with previous literature that suggests there is less anger in a concussed population than in an injured ACL population.[6]

Another noteworthy finding is the difference in emotional symptoms between males and females. Both of the female participants began crying in the middle of the athletic training room when they were told of their concussions and expressed experiencing some form of embarrassment for their injuries, whereas the male participants did not. Sally and Lisa also seemed to experience more anger than Jack and George. There is no known research that looks at differences in emotional symptoms between genders regarding concussions; however, females have been shown to experience more emotions at concussion baseline testing and post-concussion than males.[38-40] Additionally, when compared to men, research shows that women generally show a physiological difference in emotion and are more sensitive to emotional situations.[41] Sensitivity to emotional situations is individualized and relies on what each person considers an emotional situation.[41,42]

The closest known literature with a qualitative based methodology was an editorial investigating the experiences of athletes with post-concussion syndrome published by Echlin. One of the largest themes that corroborate the information contained in the Echlin editorials is the frustration from concussions being an "invisible injury" and ongoing symptoms.[5] Frustration was one of the key sub-themes that developed from their emotional response to injury, mainly caused by being held out of practice and competition. However, Sally expressed her frustration with ongoing symptoms as well. In this way, frustration was a very present part of three of the four participants' experiences in this study as it was in nearly all of the case studies. It appears

frustration may stem from different reasons depending on the person involved and as a result athletic trainers may benefit from understanding the individual personalities of their athletes.

Sport culture may have played a role in the student-athletes' level of frustration. Wiese-Bjornstal et al., suggests athletes are part of a culture that values sports achievements and that many athletes are unwilling to quit playing regardless of the pain experienced.[43] Previous research looking at male athletes has suggested a link between pain tolerance and playing with injuries and athletes reporting pain and injuries as "part of the game."[44] Research suggests women who compete in competitive sports are socialized into accepting this thought as well.[45] George's feeling of letting his teammates down because he was missing a game may be caused by this link. Furthermore, this culture of sport achievements may be the cause of all four participants initially resisting their restriction from competition. Sally and Lisa both participate in non-contact sports (tennis and swimming, respectively) that typically have very few concussions. In fact, no known research provides concussion incidence rates for swimming or tennis. Sally supported this reasoning explaining that part of her embarrassment stemmed from the rarity of being diagnosed with a concussion as a tennis player.

The experiences discussed in this study supports the hypotheses put forth by Wiese-Bjornstal et al., that suggests the urgency to return to sport activity may contribute to injured athletes feeling frustration, depression, and anger; further motivating the athlete during a long rehabilitation.[43] This hypothesis stems from a study that found competitive athletes recover faster from ACL surgery than recreational athletes.[46] Concussion rehabilitations typically last for about two weeks (7-10 days of symptoms, one week of gradual return to exercise)[30] whereas ACL tears typically last at least six months. However, multiple participants in this study explained they wanted to play instead of sitting out, potentially causing their experiences of frustration and

anger. Furthermore, the student-athletes' experiences in this study support the findings of Shelbourne and Foulk that suggested high-level athletes are impatient, making them less likely to be compliant with RTP protocols.[47] All four participants made references to wanting to get back immediately instead of waiting for the return to play protocol to be completed. This may be interpreted as a sign of being impatient.

Another theme in this study was the fear of letting their teammates down. McCrea et al., found this to be a common reason to not report their concussions,[19] however, it is important to note that this reasoning was not used by any of the participants. This suggests there may be another reason for this fear that was present in three student-athlete's experiences. They may have not wanted to let their teammates down because the general culture of sport and team unity generally does not support athletes who will not play through pain.[43] Athletes are expected to accept their injury and resulting pain as part of their game.[43] In addition, Sye et al. found that 12.4% of New Zealand rugby players had not reported a concussion and that about 50% were unaware of return to play protocols.[20] Furthermore, Kaut, et al. found 18.7% of college atheltes (male and female) reported they did not report dizziness following a concussion.[48] Sally supported these findings when she reported being unaware of the concussion policy and if made aware of it may have lied about her symptoms. This is something all athletic trainers should watch for when caring for a concussed athlete, because if athletes are hiding their symptoms they may be allowed to return to play too early. Furthermore, Lisa repeatedly did not follow instructions regarding her RTP. She admitted to not limiting her activity when told to and as a result continued riding her bicycle around campus. This eventually led to her crashing her bike, which she attributed to her concussion symptoms. One way to help prevent this may be for athletic trainers to warn athletes about the risks associated with not reporting symptoms or

following rehabilitation orders (such as second impact syndrome) prior to asking about their symptoms.

Although a small sample size is acceptable in qualitative research, a larger number of participants may have made for stronger results. Future research should continue looking at individual experiences of concussions including potential gender differences in emotional symptoms following a concussion**,** the presence of frustration and its sources, and the affects of concussions on students' ability to take notes, quizzes, exams, and simply pay attention during class.

Based on the results of this study, concussions seem to be very individualized injuries and it is important for coaches, physicians, and athletic trainers to understand athletes' individual needs and personalities. A better understanding of what student-athletes' experience will hopefully assist athletic trainers in guiding these individuals through the recovery process. This involves having a good rapport with student-athletes and understanding that some athletes may show anger and frustration with the injury. It is also important to understand that these emotions are likely not directed toward the athletic trainer, but toward the concussion itself. Athletic trainers may benefit from being more aware of their athletes' fears, frustrations, and reactions to their concussions; understanding that everyone will likely respond to their concussion differently.

In conclusion, this study helped to explain the personalized experiences of four NCAA Division I student-athletes. The six themes that developed from these interviews were focus on symptoms, experiences of concussion testing, fear of failing to meet teammate expectations, support from friends and family, and effect on school. Although these findings are not able to be

generalized to all NCAA student-athletes, they will give athletic trainers an idea of what student-athletes may be experiencing during a concussion.

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APPENDIX A

RESEARCH QUESTION, DELIMITATIONS, LIMITATIONS, ASSUMPTIONS, AND DEFINITIONS

Research question

1. 1 What is a student-athlete's lived experience of a concussion?

Limitations

1. Researcher's experience of suffering a concussion and as a Certified Athletic Trainer may lead to bias.
2. Familiarity between research and participants.

Delimitations

1. Participants are athletes at a NCAA Division I institution.
2. Only first concussion of season will be used for an athlete.
3. Concussion must have occurred in-season.

Exclusion Criteria

1. Experience a second concussion prior to interview.
2. Concussion occurs out of season.

Assumptions

1. The interviewer is reliable.
2. Participants will be truthful.
3. Participants have suffered a concussion and have followed the school's concussion policy.

Definitions

1. Concussion—as diagnosed by team physician

2. Concussion protocol—per school that is being used
3. Phenomenology—Qualitative style of research with few participants used to examine a person's lived experience of a specific event

APPENDIX B

EXTENDED REVIEW OF LITERATURE

The purpose of this phenomenological study is to examine NCAA division I student-athletes' lived experiences of suffering and recovering from an in-season sports-related concussion. To carry out this study it is necessary to complete a critical review of the literature, which will continue through the data collection, data analysis, and synthesis stages of the research.

This critical review explores the known literature regarding concussions as well as known qualitative studies regarding injuries. Nine major areas of literature are being reviewed for this study. They are: (a) background, (b) physiology, (c) symptoms, (d) current testing techniques, (e) current recommendations, (f) athletic trainers' practice patterns, (g) consequences of suffering a concussion, (h) psychological effects, and (i) qualitative studies used to examine other injuries. Examination of all of these aspects of concussion research will provide an understanding of the definitions, prevalence, signs and symptoms, recommendations, current testing abilities, and psychological states a person treating a concussion may need to know and understand.

To conduct the literature review, the researcher is using multiple information sources including books, Internet resources, and professional journals. These sources were primarily accessed through PubMed, MEDLINE, CINAHL, and SPORT Discus. There is no delimiting timeframe, however, the majority of concussion research has been performed within the last 15 years. The researcher will be attempting to point out existing gaps in the literature throughout this review.

Background

Concussions are the most common head injury in sports with an estimated 1.8-3.6 million occurring each year in the United States.[1] There is no set definition of what a concussion is,[8,49] but is generally defined as "a pathophysiological process affecting the brain induced by direct or indirect biomechanical forces." Common features of concussions include a rapid onset of typically short-lived neurological impairment and a range of acute clinical symptoms that reflect a functional disturbance.[50]

This includes the Center for Disease Control's (CDC) estimate of approximately 300,000 TBIs in which the person experiences loss of consciousness each year.[1] Three years later, Summers et al. estimated that 1.4 million people are treated for TBIs annually.[51] If you were to apply the 53% non-reporting rate presented by McCrea et al.,[19] this number would fall in the total estimated range presented by Langlois et al in 2006.[1] When looking at the number of concussions in high school alone, there is a very wide range of 62,816 per year[52] to 135,901[9] in a one year span.

The accepted range in the literature of incidence rates of concussions is between 3.9%[52] and 8.9%[7,9,53,54] with more of the concussions occurring in games rather than in practices.[9,55] Higher rates have been reported in the literature. Shankar et al. reported 9-12% of all injuries were concussions[55] and Delaney et al. reported between 62.7% and 70.4% of athletes have experienced a concussion in their life.[12] This is contrasted by a 24% occurrence rate in the 1970s.[56] Guskiewicz et al. added that 14.7% of athletes who suffer a concussion will experience a second concussion in the same season.[7]

Concussions represent 96.1% of all head injuries,[55] raising awareness of the injury. As concussions have become more commonplace in the literature and the media,[57] playing time lost

as risen as well. There was an overall increase in playing time lost due to concussions between 1998 and 2008.[58]

There are a vast number of symptoms associated with concussions, however the most common tend to be headache, dizziness, and confusion. Furthermore, headaches tend to be the single most commonly reported symptom.[7-9,11,12] On occasions, other symptoms were also reported in the top 3 such as blurred vision. It should be noted that headache was still the most common symptom reported.[59] Other signs and symptoms of concussions included loss of consciousness, retrograde amnesia, post-traumatic amnesia, nausea, fatigue, sleep disturbances, double vision, blurred vision and photosensitivity.[7,9,11,12,48,59] Research shows athlete's post-concussion symptoms typically return to normal between two and 10 days post-injury.[7,9,11,12,60] This coincides with typical return to play guidelines of 1-2 weeks.[61-63] However, symptoms can last much longer. Some literature suggests more severe concussions can have symptoms lasting as long as 16 days out or even for more than 21 days post-injury.[9,11]

The hallmark signs of a concussion are confusion and amnesia,[8] with loss of consciousness widely considered the most important symptom of a concussion.[62,63] Loss of consciousness rates is reported to be between 3.9-39%, with the most commonly reported numbers between 4-9%.[7-9,11,12,48,59,64] In 2006, the Center for Disease Control (CDC) reported 300,000 concussions featuring loss of consciousness occurring in the United States each year.[1] However, the importance of loss of consciousness on the outcome of concussions has been refuted in the literature.[61,65-67] Posttraumatic amnesia has been shown to be a possible predictor of more severe concussions as opposed to a short period of loss of consciousness, as symptoms typically last longer when posttraumatic amnesia is present as opposed to loss of consciousness.[8,11,61]

Postural stability and gait may also be affected following a concussion.[68-73] Current research suggests an individual will decrease gait velocity and increase sway following a concussion, leading to decreased postural stability. Adjustments are then made by the individual to attempt to control these deficits. Short-term gross deficits have been shown to last for three to five days,[68,69] whereas smaller deficits have been shown to last as long as 28-30 days.[71,72,74] These deficits increase when the individual is given a cognitive task as well, called dual tasking. Research shows an individual will alter their gait mechanics by slowing their velocity and altering center of mass to compensate for the increased work the brain has to do cognitively.[70,73] The center of mass medial-lateral sway decreases following a concussion while performing a single task. However, when a cognitive task is added, the medial-lateral sway increases and the gait velocity slows. This suggests the addition of a second task compromises gait performance in concussion patients.[73]

In 2009, the third International Conference on Concussion in Sport released a consensus statement on concussion. In this they explained the multitude of tests that can be used diagnose/rule out a concussion.[33] One of these tests Standardized Assessment of Concussion (SAC).[75] Orientation type of questions were first recognized to significantly represent the presence of a concussion in the mid-1990's.[59] In 1998, the American Academy of Neurology (AAN) recommended the development of a standardized objective sideline tool to better identify the presence of a concussion leading to the creation of the SAC test.[31,63] In 2001 this test was determined to be valid and reliable,[76] and is now one of many tools recommended for use by the National Athletic Trainers' Association (NATA).[30]

There are, however, limitations to the SAC test. SAC is a short-term test that is designed to measure gross cognitive impairments immediately following a concussion. In most people,

SAC returns to baseline within about 48 hours. Scores also tend to increase in both the control group and the concussion group representing a possible learning curve to the test if taken multiple times in a relatively short period of time.[77] However, Valovich found there was no practice effect with SAC.[78]

Current return to play guidelines require athletes to be symptom free prior to return to play,[61-63] making it necessary to evaluate symptoms on graded symptom checklists.[79,80] There are a variety of checklists used when determining return to play, however the most common symptoms of a concussion (as previously noted) are all accounted for in each checklist.[49,79,80]

Another aspect of concussion management and assessment is postural stability.[30] It is important to identify whether or not there are postural stability deficits and there are multiple ways to do this, force plates and clinical application.[81] Some research suggests postural control deficits last for up to five days post injury in concussion patients,[68,69] making it necessary to have objective tools for measuring an athlete's progress in returning to play.[81] Conversely, Slobounov and Cavanaugh suggest postural control deficits may be present as far as 30 days out. This, however, can only be detected by highly sensitive tools are not very clinically applicable.[74,82]

One of these tools in measuring postural control is the Sensory Organization Test (SOT). SOT is designed to intentionally disturb the sensory selection process and it consists of three 20-second trials. These trials are performed under three different visual conditions and two different surface conditions, totaling six conditions. The idea is to stand as motionless as possible and at the end a score is provided with higher scores being better. A major limitation to this test is the cost as force plates are required.[81]

In the early 2000's a new test was created by researchers at the University of North Carolina called Balance Error Scoring System (BESS).[81] This test is similar to SOT in that there

are six total trials and a score is obtained. However, there are major differences.[81] BESS is conducted by placing the athlete in a series of different stances that are each performed twice, once with eyes-open and once with eyes-closed. Each stance is held for 20 seconds and errors are recorded for a variety of mistakes. Unlike SOT, lower scores represent a better outcome with BESS.[81,83,84]

Although clinically applicable for sports medicine personnel such as athletic trainers and team physicians,[78,81,83] BESS does have limitations. The first of these limitations is the [78,83-85] practice effect. One study administered BESS four times over a seven-day period. During this study, test scores dropped significantly from the first to the last testing session.[78] Another limitation to BESS is the effect exercise has on the test. Fox et al. found BESS scores are actually worse for up to 13 minutes following exercise. This makes BESS inaccurate immediately following exercise. As a result, Fox recommends waiting a minimum of 13 minutes after the concussion occurs if they are in a game or practice at the time.[83] A third limitation to BESS the effect the environment has on the outcome of the test. In 2007, Onate et al. found a significant increase in errors when the test was performed in a louder environment than the baseline. As a result they recommend performing all BESS tests in the same environment in which the first was performed.[84] Both intra- and inter-reliability of BESS fall below an acceptable level of 0.75. However, when BESS was modified to eliminate the double-leg stance portion, reliability improved to an acceptable level.[85]

Another form of testing in concussion management is neuropsychological testing (NP).[30] NP testing can be performed via either paper and pencil[67] or a computer.[49] Computerized NP testing seems to becoming more popular now among colleges and clinics in assessing a concussion. Computerized NP tests are also more objective than the paper and pencil test.[32]

Furthermore, pencil and paper tests are around 43% sensitive to concussion whereas HeadMinder CRI and ImPACT (two of the three computerized tests that are available to the public) were just under 80% sensitive to concussion.[86] These numbers make them much more sensitive to correctly identifying a concussion than paper and pencil.

Of the four computerized NP tests, one is only used for the United States Military (ANAM) and the other three are commercially available (CogSport, HeadMinder CRI, and ImPACT). Of the three commercially available programs, CogSport is the least reliable. Overall, NP testing is a reliable and objective way of assessing mild Traumatic Brain Injury (TBI) such as concussions.[87]

The consensus among the literature revolves around using a battery of concussion tests. This test battery should involve multiple tests that examine cognition, postural control, and reported symptoms following a concussion. The research is also in agreement regarding the generalization of concussion guidelines.

Concussions are highly individualized and as a result everyone should have a baseline score of all tests in a specific test battery.[32,86,88-90] This consensus in the research is supported by the very high sensitivity (89-96%) of the test battery when all recommended aspects of the battery are used.

Just as there is no set definition for concussions, there are no universally accepted concussion grading scales.[61] There are currently eight grading systems for concussion,[61] three of which seem to be used the most in the literature. Those are the Colorado Medical Society[62] (Colorado scale), the AAN grading scale,[63] and the Evidence-Based Cantu Grading System[61] (revised Cantu scale). All of these grading scales consider loss of consciousness to be the most

important symptom with the exception of the revised Cantu scale. This scale emphasizes the duration of symptoms and amnesia instead.[61]

There are many different return-to-play (RTP) guidelines depending on the grading scale used. Each of the three commonly used[57] grading scales has their own RTP guidelines as well.[91] Colorado[62] and AAN[63] both allow RTP in the same day if signs and symptoms last less than 15 minutes (Grade I). In contrast, Cantu[61] requires athletes that present with signs and symptoms lasting less than 30 minutes and with no loss of consciousness or posttraumatic amnesia (Grade I) are held out for a minimum of one week asymptomatic. Everyone has identical RTP guidelines for Grade II concussions.[91] Grade III differs once again. Once loss of consciousness occurs when using Colorado or AAN, the patient must be transported to the hospital. However, RTP guidelines between these two organizations differ for Grade III concussions. Colorado requires the patient sit out a minimum of one month asymptomatic whereas AAN allows RTP after one week asymptomatic.[91] Cantu allows RTP after one month asymptomatic following a Grade III concussion.[61]

The general RTP guidelines among positions statements and consensus statements do not follow any of the previously mentioned guidelines. The National Athletic Trainers' Association (NATA) position statement on concussions and the Concussion in Sport (CIS) group's Vienna conferences guidelines both recommend a step-wise program. This program would begin when the patient becomes asymptomatic and returns to baseline on their concussion tests. The patient then should increase their activity until all of the steps are completed. The patient must then remain asymptomatic throughout the entire process. Both groups recommend patient's scores be compared to their own personal baseline scores and that a complete test battery should be used in the diagnosis of a concussion.[30,90]

The literature does point to age as being a possible variable that affects the risk of concussion,[7,90,92] however, there is conflicting research.[9] Guskiewicz et al. reported a rate of 1.03 concussions per athlete exposure (a/e) at the high school level. This was more than two times the Division I exposure rate (0.49 a/e) and just less than double the total college rate.[7] Additionally, Field et al. found that high school athletes seem to take a longer time to recover from a concussion than college students do.[92] Conversely, Gessel et al. found a higher rate of incidence in college-aged athletes. It can be hypothesized that there are higher athlete exposures, poorer protective equipment and lower skill level that caused the rates to be higher for high school students in some of the studies.[9]

There literature seems to be much clearer regarding sex differences than age differences. In nearly every study, women performed worse or had more negative outcomes than men. Females tend to report significantly more symptoms than males do. This can lead to being held out longer because it is taking them longer to become symptom free.[40,93] On average, females become 1.7 times more mentally impaired than males following a concussion.[38] Females also have a higher rate of sustaining a concussion during a game than males do.[53] Finally, women tend to score better on the verbal baseline scores while taking their NP test.[40,76] However, males tend to score better on visual scores.[40]

Multiple researchers have examined sports medicine practitioner's practice patterns in dealing with concussions. One of the first on this topic was published in 2001 when Ferrara et al. examined athletic trainer's practice patterns and management of concussions. They found that athletic trainers most often use the Colorado and Cantu RTP guidelines when returning an athlete to competition. No use of return to play guidelines was the answer with the third most responses. They also found that the majority of athletic trainers (nearly 70%) use

clinical examination or a symptom checklist to evaluate concussions. Finally, it was determined that the majority of athletic trainers seem to be using either a physician recommendation or clinical examination when determining RTP.

Four years later, Notebaert and Guskiewicz performed a similar study looking to update practice trends by athletic trainers as well as determine compliance rates with the newly developed NATA positions statement on concussions. This study went into further detail regarding preferred assessment tools and RTP guidelines. They discovered that about 85% of athletic trainers used symptom checklists and about 95% used clinical examination to assess possible concussions. The also found that at least 80% of athletic trainers use symptom checklists, RTP guidelines, physician recommendations, and clinical examinations when returning an athlete to participation in their respective sport. Finally it was determined that 97% of athletic trainers use either themselves, the patient's primary care physician, or the team physician as the person responsible in making the RTP decision.[94]

The most recent study looking at practicing trends of athletic trainers came in 2009 by Covassin et al. This study was similar to the 2005 study but also wanted to determine how athletic trainers were using ImPACT (a neuropsychological test used in the concussion assessment battery).[90] The top four methods for assessing a concussion were clinical exam (100%), computerized neuropsychological testing (87.5%), physician recommendations (85.7%) and symptom checklists (77.2%). They also found the sports that were most likely to be baseline tested were football and soccer.[32] Using a baseline in these sports is supported by the literature for being high-risk sports.[9,12,52]

Head injuries have been discussed and studied since the ancient Greeks. The most notable of Greeks to write about head injuries was Hippocrates in the Hippocratic corpus where

he described the clinical symptoms of brain injuries. It wasn't until 900 A.D. that Rhazes first clearly described a concussion as an abnormal physiologic state as opposed to a severe brain injury. There was little development in the topic for about the next 700 years until the invention of the microscope in the 1600's. Starting in the late 16th Century and early 17th Century, people's views on why concussions happen shifted from being transient in nature to one that is clinical in nature with temporary neural deficits.[95] However, arguments of some long lasting or even permanent damage are being made.[37,74,82,96-100]

Published in 2001, Giza and Hovda describe the neurometabolic cascade. The neurometabolic cascade theorized to be the immediate physiological reaction in the brain. The cascade begins with the random release of excitatory amino acids and a massive efflux of potassium ions. This triggers a very brief period of hyperglycolysis followed by a large calcium influx, mitochondrial dysfunction, decreased oxidative metabolism, diminished cerebral glucose metabolism, reduced cerebral blood flow, and axonal injury. Later stages include apoptosis, chronic alterations in neurotransmission, and axonal disconnection. They go on to explain that clinical signs and symptoms are present due to neural dysfunction, however it is difficult to match certain symptoms with a specific stage of the neurometabolic process. The entire process usually lasts for up to four to 10 days, however the majority of actions in the process are returned to normal within 24 hours of injury.[37]

Multiple concussions have been known to cause professional athletes to retire early from their respective sports.[8] The literature disagrees on specific numbers, however, is in agreement that having a history of concussions effects future concussions.[8,101-104] Research has determined that having a history of multiple concussions increases the risk of having a future concussion.[8,104] High school and collegiate football players who sustain a concussion are nearly three times more

likely to sustain a second concussion in the same season than those players who have not suffered a previous concussion.[8] Zemper et al. challenges this number, finding that football players with previous concussions are 5.8 times more likely to suffer another concussion as opposed to those with no history of concussion.[104]

In addition, the literature generally agrees having a history of concussions may make symptoms worse and/or last longer.[101-103] Collins et al. found that high school athletes with a history of three or more concussions were more than nine times more likely to present with three or four on-field abnormal markers. These abnormal markers are loss of consciousness, anterograde amnesia, retrograde amnesia, or confusion.[101] Iverson et al. supports this finding and adds that having a history or concussions can lead to lower memory scores at baseline. They went further in detail to say a person with a history of concussion is six times more likely to experience post-traumatic amnesia and eight times more likely to experience five or more minutes of mental status disturbance.[103] Covassin et al. further adds to the previously mentioned studies by explaining the sex differences of baseline scores and multiple concussions. They found males with a history of two or more concussions perform worse on baseline scores than females with a history of two or more concussions. Furthermore, there was a dose response associated with these findings. Overall, those with two or more concussions performed worse on baseline than those with no previous history of concussion. As a result the authors recommended treating males and females differently in concussion management.[102] Their research agreed with Collins et al., in 1999, which found athletes with a history of two or more concussions performed significantly worse on Trail-making B tests than those with a history of one or no concussions.[105] To prevent a second hit to the head before the brain is entirely healed, it is recommended to sit out seven to 10 days following a concussion.[8]

There are two major definitions used when determining if someone has post-concussion syndrome (PCS). The first is taken from the ICD-10, which describes PCS as a syndrome that occurs after a trauma and presents no later than four weeks, post-injury. The second is taken from the DSM-IV, which describes PCS as a syndrome that must have symptoms continue to last for at least three months post-injury.[106] The research is in agreement there is a very small number of persistent post-concussion syndrome patients (PPPS). About 1/10 of people reporting symptoms three months post injury have a large number that can be diagnosed as post-concussion syndrome.[106,107] Cantu et al. suggest doctors are aware and teach athletes about post-concussion syndrome when presented with a head injury. They also suggest retirement to athletes with symptoms that will not go away and begin to present for weeks or months at a time as opposed to days at time.[108]

Concussions have been shown to lead into early onset of Alzheimer's in certain people.[1,109] Langlois et al. found a 1.5 times increased risk of depression, a 2.3 times risk of future moderate TBI, and a 4.5 times risk of Alzheimer's disease in conjunction with aging.[1] A small sub-set of retired NFL players was examined that had been diagnosed with the early stages of Alzheimer's disease. Their history from sports showed that there is a possible link between repeat concussions and earlier onset of the disease.[109] DeBeaumont et al. supports these arguments of long lasting effects of a concussion. They showed that sports concussions might result in long-term motor system dysfunctions that might be associated with intracortical inhibitory system abnormalities.[97]

There is a general consensus among sports medicine professionals that not all concussions are being reported. McCrea et al. found a 53% non-reporting rate in among high school football players. Those that are reporting their concussions are doing so to their athletic

trainer 76.7% of the time. Of the 53% that did not report their concussions; 66.4% said they did not think it was serious enough to report the concussion, 41% did not want to leave the game, 36.1% were not aware they had a concussion, and 22.1% did not want to let down their teammates by leaving the game.[19] Williamson et al. reported that they are having similar problems of under-reporting in Canada, however it is mainly from the coaches and staff of the minor hockey teams. As a result, Hockey Canada has shown a desire to increase the use of injury reports in minor hockey across the country.[110] Kaut et al. recommends examining the education programs involving concussions to ensure we are adequately education the public.[48]

Many investigators have evaluated somatic and neuropsychological symptoms of concussions, however, emotional responses to concussions have little research available on them and for the most part have been ignored.[111] Having said this there is some literature regarding emotions and depression. There is a strong link between personality traits and self-reported concussion like symptoms. Participants who reported more post-concussion like symptoms also scored higher on depressive, dependent, sadistic, negativistic, borderline, anxiety, somatic, dysthymia, and major depression scales.[10]

Post-concussion like symptoms were also studied to see if they are associated with certain demographics. Healthy people were included in the study and it was determined that healthy people report a significant amount of post-concussion like symptoms on a normal basis. As a result, the literature recommends to use caution when diagnosing post-concussion syndrome and to carefully decipher which symptoms are actually the result of a head injury.[112]

Emotional responses have been researched in the concussion field occasionally. This research compared emotional responses after an ACL tear to a concussion. It was determined that emotional responses emerge after athletic injury. Specifically the research strongly suggests

that athletes whom suffer from concussions react differently than those that suffer from minor musculoskeletal injuries. It is suggested that emotional responses are not only dependent on the type of injury but also to the individual.[6] Furthermore, depression tended to last longer in the musculoskeletal groups (usually ACL) than in the concussion groups. This is thought to occur because ACL injuries usually take much longer to recover and are initially more severe than concussions.[15]

Overall there are overwhelming weaknesses in the literature when it comes to psychological factors associated with concussions.[113] Emotions are occasionally studied quantitatively, however there are no qualitative studies known, specifically involving the athlete's experience while suffering from a concussion.

APPENDIX C

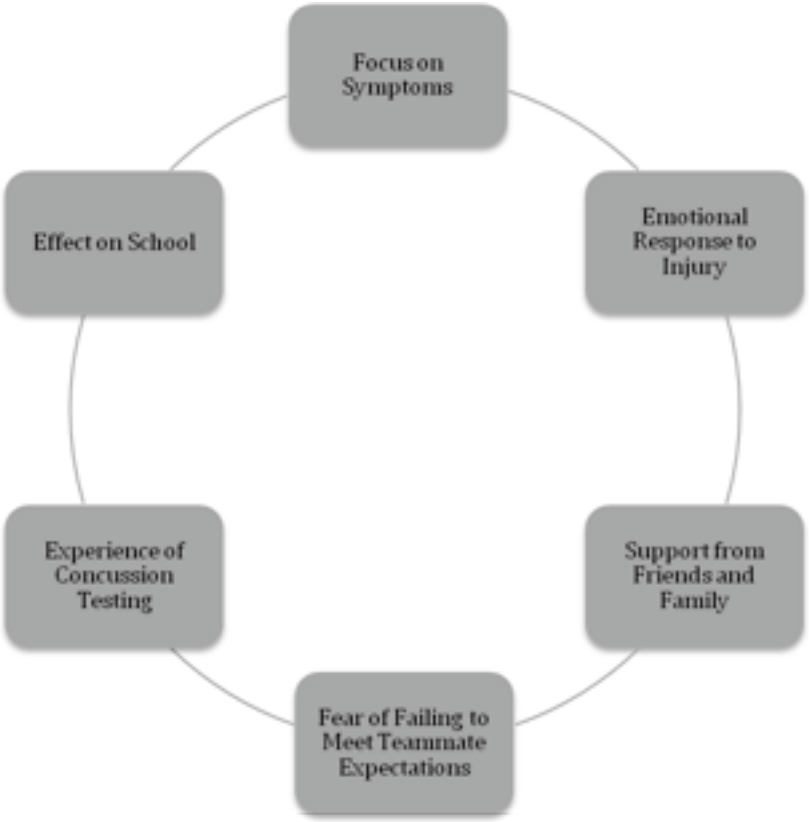

Figure 1: Inter-relatedness of themes