

Kim, Chol Ho J., Examining the association between sleep modifiers and recovery time following sports-related concussion. Master of Science (Clinical Research Management), May 2022, 22 pp., 4 tables, 2 illustrations, references, 29 titles.

Abstract:

Although previous researchers support the association of sleep disturbances negatively impacting recovery time from sports-related concussion (SRC), the degree of impact sleep disturbances have on recovery time from SRC is not well-defined. This study uses the presence and absence of sleep modifiers in the Concussion Clinical Profiles Screening tool to compare and quantify recovery time from SRC in a preadolescent, adolescent, and young adult sample. We examined patient records data obtained between August 2019 and December 2021 with inclusion criteria (1) injury date <30 days from initial evaluation, (2) SRC diagnosis, and (3) completion of treatment. Patients (sample median age 15.4 (14.3, 17.1)) were grouped based on the presence or absence of sleep modifier. Adjusting for other risk factors of prolonged recovery time (i.e., vestibular primary clinical profile, personal/family history of migraines, and personal history of anxiety/depression), the presence of sleep modifiers substantially increased recovery time by 1.45-fold ($p < 0.001$).

EXAMINING THE ASSOCIATION BETWEEN PRESENCE OF SLEEP MODIFIERS
AND RECOVERY FOLLOWING SPORTS-RELATED CONCUSSION

Chol Ho James Kim, B.S., B.A

APPROVED:

Major Professor

Committee Member

Committee Member

Committee Member

Chair, Department of Pharmacology & Neuroscience

Dean, School of Biomedical Sciences

EXAMINING THE ASSOCIATION BETWEEN PRESENCE OF SLEEP MODIFIERS AND
RECOVERY TIME FOLLOWING SPORTS-RELATED CONCUSSION

PRACTICUM

Presented to the Graduate Council of the
School of Biomedical Sciences
University of North Texas
Health Science Center at Fort Worth
in Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

in Clinical Research Management

By

Chol Ho James Kim, B.S., B.A.

Fort Worth, Texas

May 2022

ACKNOWLEDGEMENTS

Thank you, Dr. Dorota Stankowska for your time and help throughout my time in the Medical Science program and as my major professor after transferring into the Clinical Research Management program. Thank you for your kind and encouraging words throughout this journey. Thank you, Dr. Kathleen Borgmann for your analytical prowess and guidance throughout my thesis writing process. Thank you, Dr. Simon Driver and Dr. Erin Reynolds for your patience, time, and guidance during my internship experience. Thank you for welcoming me to the site and making my time there a memorable experience.

I also want to thank Kayla Covert from the Baylor Scott & White Sports Concussion Clinic for your friendliness, analytical mind, and support. I also want to express my gratitude to Evan McShan, Megan Reynolds, Katelyn Brown, and Taylor Gilliland. Everyone's patience, support, and time throughout my internship experience is greatly appreciated. Thank you.

TABLE OF CONTENTS

	Page
LIST OF TABLES.....	iii
LIST OF ILLUSTRATIONS.....	iv
LIST OF ABBREVIATIONS.....	v
Chapter	
I. INTRODUCTION.....	1
II. EXAMINING THE ASSOCIATION BETWEEN SLEEP MODIFIERS AND RECOVERY FOLLOWING SPORTS-RELATED CONCUSSION	
Background.....	3
Literature Review.....	7
Objectives.....	10
Significance and Methods.....	11
Statistics and Results.....	12
Discussion.....	16
Conclusion.....	19
References.....	21
III. INTERNSHIP EXPERIENCE	
Internship Site.....	24
Journal Summary.....	27

LIST OF TABLES

	Page
Table 1 – Patient Demographics.....	12
Table 2 – Concussion and medical history.....	13
Table 3 – Injury details.....	14
Table 4 – Multivariate regression.....	14

LIST OF ILLUSTRATIONS

	Page
Figure 1 – Clinical Profiles of Concussion.....	4
Figure 2 – BSW Sports Concussion Program Exertion Study Cone Layout.....	5

LIST OF ABBREVIATIONS

SRC	Sports-related concussion
mTBI	Mild traumatic brain injury
PCS	Post-concussion syndrome
CCPS	Concussion clinical profiles screen
PSQI	Pittsburgh sleep quality index
SCAT3	Sports Concussion Assessment Tool – 3 rd edition
BSW	Baylor Scott & White
REDCap	Research Electronic Data Capture
SM group	Sleep modifier group
NM group	No modifier group
IQR	Interquartile Range
PCSS	Post-Concussion Symptom Scale
VOMS	Vestibular Ocular Motor Screening
EHR	Electronic Health Record
GLB/CVA	Greater Lifestyle Balance/Cerebrovascular Accident
COVID-19	Coronavirus Disease 2019
TBI	Traumatic Brain Injury

CHAPTER I

INTRODUCTION TO THE STUDY

Sports-related concussions (SRC) are mild traumatic brain injuries that disrupt normal cognitive functioning in the brain. The incidence rate of SRC is estimated to be 1.6 to 3.8 million cases annually in the U.S. alone (Rutland-Brown et al., 2006). Common symptoms of SRC are categorized into physical, cognitive, emotional, and sleep-related symptoms. Sleep-related symptoms affect 30-70% of SRC patients potentially resulting in poor quality sleep (Kontos et al., 2019). Poor quality sleep can lead to a decrease in cognitive function, impaired memory and learning, and decreased alertness (Malhotra, 2017). With the impact SRCs and sleep disturbances have on cognitive performance, it is beneficial for clinicians and patients to understand the impact that sleep disturbances have on recovery. As problems with obtaining good quality sleep is found in 30-70% of SRC patients, it is important to quantify the impact sleep disturbances have on recovery time (Kontos et al., 2019).

Clinical profiles of concussion were first introduced by Collins et al. in 2014 to create a multidisciplinary conceptual model of clinical care (Collins et al., 2014). Common symptom clusters of concussion were grouped into six clinical profiles – anxiety/mood, cognitive-fatigue, posttraumatic migraine, ocular, vestibular, and neck/cervical. Clinicians can identify clinical profiles in patients and refer them to specialists – for example, patients with a vestibular clinical profile can be treated by a vestibular therapist. Kontos et al. (2019) updated the clinical profiles model removing the neck/cervical clinical profile introduced by Collins et al. (2014) and

introduced modifiers of concussion. Kontos et al. (2019) debuted sleep and neck/cervical concussion modifiers and their effect on clinical profiles. They are called modifiers as they can negatively affect all five of the clinical profiles, potentially resulting in greater symptom severity and prolonged recovery time.

Kontos et al. (2020) debuted the Concussion Clinical Profiles Screening (CCPS) tool, a concussion symptom inventory tool modeled to identify clinical profiles and modifiers in SRC patients. As a concussion symptom inventory tool, the CCPS is a self-report questionnaire designed to identify and rate the severity of concussion symptoms. As each symptom question is correlated with one of the five clinical profiles or one of the two modifiers, patient symptoms are graded and ranked into clinical profiles and modifiers. Hence, the presence of a clinical profile or modifier indicates experiencing some level of symptoms relating to the respective clinical profile or modifier.

This practicum project examined the association between sleep modifiers and recovery time from SRC in a preadolescent, adolescent, and young adult sample. It also quantified the impact the presence of a sleep modifier has on recovery time from SRC. Data for this project was obtained from the Baylor Scott & White Sports Concussion Program in Frisco, Texas. Recovery time from SRC was calculated and compared between patients with the presence and absence of sleep modifiers.

CHAPTER II

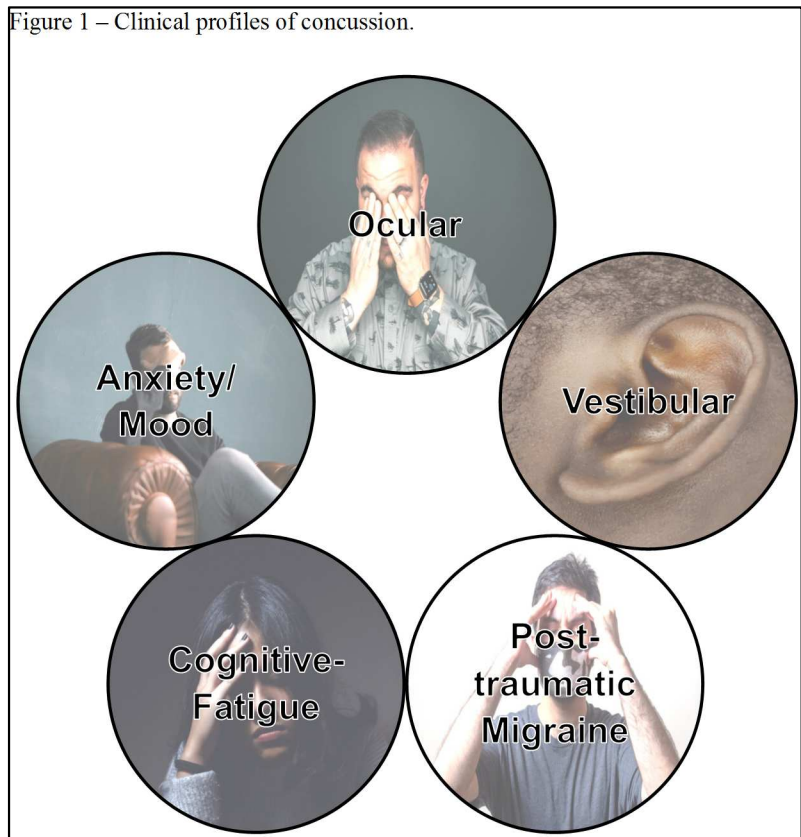
BACKGROUND

A concussion is a mild type of traumatic brain injury (mTBI) that disrupts normal brain activity (Center of Disease Control and Prevention, 2016). It is estimated between 1.6 - 3.8 million incidences of concussion each year are related to participation in sport (i.e., sports-related concussion or SRC) (Rutland-Brown et al., 2006). Concussions cause a range of symptoms, the more common symptoms are headache, amnesia, confusion, and sleep disturbances (Mayo Clinic, 2020). Concussions may also cause noticeable symptoms (e.g., cognitive, physical, emotional, or sleep disturbances) for days, weeks, or months post-concussion (CDC, 2010). A study by Eisenberg et al. looked at patients who presented at a pediatric emergency department and found cognitive symptoms (headache, fatigue, taking longer to think) persisting past one-month post-injury (Eisenberg et al., 2014). Abnormal persisting symptoms of concussion are referred to as Post-Concussion Syndrome (PCS). PCS is defined as experiencing at least three cognitive, physical, and/or emotional symptoms for at least three months. Babcock et al. (2013) looked at a sample of 406 children and adolescents (5-18 years) who presented at a pediatric ED and interviewed them three months post-injury to assess for symptoms. They found 119 children and adolescents developed PCS (Babcock et al., 2013). Of the child and adolescent patients who developed PCS, Babcock et al. found these patients to miss a mean of 7.4 days of school with a standard deviation of 13.9 days (Babcock et al., 2013).

Because of the debilitating effects, concussions can have a negative impact on individuals. Given the prevalence of concussions in sports, it is important to better understand the scope of their symptoms and impact on the recovery.

Sleep disturbances are a common symptom of SRC (Kostyun et al., 2015). Sleep disturbances have been shown to negatively impact academic performance and sleep deprivation has been shown to negatively impact athletic performance (Goel et al., 2009; Philip et al., 2004). Sleep disturbances are leading to poorer sleep quality and sleep deprivation. Poor quality sleep can lead to a decrease in cognitive function, impaired memory and learning, and decreased alertness (Malhotra, 2017). Sleep disturbances in a child, adolescent, and young adult population could have a detrimental impact on both athletic and academic performance. Research looking at inflammatory biomarkers could offer evidence to the association between sleep and SRC. A prospective study looked at acute blood-based biomarkers at baseline and post-SRC to determine whether the presence of inflammatory markers could discriminate between concussed and controls. The authors found inflammation biomarkers significantly increased post-SRC compared to baseline (Meier et al., 2020). Nitta et al. identified two serum inflammatory biomarkers of SRC and their potential as risk factors for prolonged recovery (Nitta et al., 2019). Additionally, Irwin et al. found sleep disturbances to be associated with increased levels of inflammation markers in healthy individuals (Irwin, 2019). This could suggest an additive effect for patients with sleep disturbances and elevated inflammation marker levels due to SRC (Meier et al., 2020).

The Concussion Clinical Profiles Screening (CCPS) Tool was introduced in 2020 by Kontos et al. to create a symptom inventory tool capable of assessing for concussion clinical profiles and providing specific information about symptoms (Kontos et al., 2020). Clinical profiles of concussion were first introduced in 2014 by Collins et al., to create a



multidisciplinary conceptual model of clinical care (Collins et al., 2014). Common symptoms caused by concussions were organized into clinical profiles which allow clinicians to treat patients accordingly. There are five clinical profiles: (1) anxiety/mood, (2) cognitive-fatigue, (3) posttraumatic migraine, (4) ocular, and (5) vestibular (Fig. 1). However, two modifiers that are not independent clinical profiles; are known to negatively influence the clinical profiles of concussion are sleep and neck/cervical complications. These are listed as sleep and neck/cervical modifiers. As an anxiety/mood clinical profile would indicate symptomology relating to anxiety and mood, a sleep and neck modifier would indicate issues with sleep and the neck, respectively.

When clinical profiles of concussion were first introduced in 2014 by Collins et al., the clinical profiles were slightly different than the five clinical profiles presented by Kontos et al. (2020) as there were six clinical profiles. One of those original six clinical profiles of

concussion, neck/cervical, is now a modifier of concussion. The term “modifier” was not associated with clinical profiles until Kontos and researchers published their update to the clinical profiles model in 2019 and introduced the sleep and neck/cervical modifiers. Problems with sleep and the neck are considered to be modifiers due to their potential to negatively affect all five of the clinical profiles.

The CCPS identifies clinical profiles and modifiers through a 29-item symptom list with each item corresponding to a clinical profile or modifier. The CCPS assesses the patient on symptoms they are experiencing at the moment. It uses a four-point Likert scale with ‘0’ meaning the individual reports they are not experiencing that symptom item, ‘1’ indicating a ‘mild’ severity, ‘2’ indicating a ‘moderate’ severity, and ‘3’ meaning a ‘severe’ self-report on the particular item. The CCPS sleep modifier score is determined by the self-report total score for the sleep modifier questions. There are four sleep questions, and the scores to each of these questions are totaled to provide the raw score. The maximum potential value for the sleep raw score is 12. As there are four questions, the average score is the raw score divided by four. The maximum potential value for the average sleep score is 3. Non-zero sleep modifier average scores will have the presence of a sleep modifier in the CCPS. Therefore, the presence of a sleep modifier on a patient’s CCPS would indicate some level of sleep disturbance.

LITERATURE REVIEW

Kontos et al. (2019) introduced the sleep as a modifier of concussion as sleep problems affect 30-70% SRC patients. However, the symptomology of sleep problems are not clinical profiles in their own right. Kontos et al. discussed the relationship sleep problems could have with clinical profiles. For example with the anxiety/mood clinical profile, patients who are experiencing anxiety/mood symptoms could experience an exacerbation of their symptoms as a result of sleep problems such as difficult falling asleep (Kontos et al., 2019). Patients experiencing migraine symptoms might experience difficulty falling asleep due to migraine symptoms (Kontos et al., 2019).

Chung et al. (2019) examined the association between the sleep quality and recovery from SRC in an adolescent (≤ 18 years old) athlete population. They found that poor sleep quality was strongly associated with a greater time to SRC symptom resolution ($p < 0.001$) (Chung et al., 2019). The Pittsburgh Sleep Quality Index (PSQI) was utilized to assess the quality of patients' sleep. The PSQI is a validated self-report questionnaire with a score range of 0-21. Participants were grouped by their sleep quality as per the PSQI guidelines – poor sleep quality is determined by a PSQI score > 5 and good sleep quality is indicated by a PSQI score ≤ 5 . Participants were divided into a good sleep quality (GS) group and a poor sleep quality (PS) group. Median and age ranges for the GS group and the PS group were 14 years (6-18) and 15 (9-18) years, respectively. Normal recovery time was defined as having a symptom resolution time equal to or less than 30 days. Symptom resolution time was defined as the total number of days from date of injury to the date when participants report symptom resolution on their concussion symptom log. Recovery times were compared by looking at the percentage of participants in each group who had their symptoms resolved in 0-14 days, 15 days to 1 month, and > 1 month. Patients in the PS

group recovered slower compared to those in the GS group. More participants in the GS group recovered within 0-14 days compared to the PS group (46.2% vs 18.8%); while more of the PS group recovered >1 month compared to the GS group (47.9% vs 25.8%) (Chung et al., 2019).

Bramley et al. (2017) examined sleep disturbances following concussion and its association with prolonged recovery in a mixed sports-related concussed (73%) and non-sports-related concussed (27%) adolescent (13-18 years old) population. Sleep disturbance was assessed by asking participants whether they were experiencing difficulty falling or staying asleep. The severity of how difficult it was to fall or stay asleep was not assessed. This differs from the CCPS in a few ways – the CCPS improves symptom query with two more sleep questions and severity scale. It also identifies and provides the ability to control for neck modifiers, which could influence recovery time when performing analysis. Participant recovery time was defined as the number of days between the date of injury and a participant's last clinic visit. The researchers found the presence of sleep disturbance was associated with a three to four-fold increase in recovery time (Bramley et al., 2017). The parameters used to determine this were based on the median and interquartile range of the recovery times between those without sleep disturbances and those with (29 days [IQR 14-84] vs 111 days [IQR 27-311], $p < 0.0001$) (Bramley et al., 2017). Of note, median recovery time of the SRC sample was 30 days (IQR 16-100) while the recovery time of the non-SRC sample was 113 days (IQR 27-393) (Bramley et al., 2017). Patients who experienced non-SRCs (45%) were also more likely to report sleep disturbances than those who experienced SRCs (29%, $p = 0.01$) (Bramley et al., 2017). This could explain their results of the presence of sleep disturbance being associated with a three to four-fold increase in recovery time from concussion.

Hoffman et al. (2020) assessed whether differences in sleep duration had an effect on performance and recovery from SRC. 180 collegiate (19.3 ± 1.2 years old) athletes were categorized into a sleep duration category after completing the Sport Concussion Assessment Tool: Version 3 (SCAT3) graded symptom checklist at baseline and 24-48 hours post-injury. Change in sleep duration was calculated by subtracting time spent sleeping post-injury with time spent in baseline. Participants who had an hour decrease in sleep duration were categorized in the shorter relative sleep group. Those who did not experience more than an hour magnitude of change in their sleep were categorized into the no sleep change group. Lastly, participants who experienced more than an hour increase in sleep duration were categorized into the longer relative sleep group. Symptom recovery was determined as the number of days it took participants to become asymptomatic after injury. The date a participant is considered asymptomatic is the date they are given medical clearance (± 1 day) to begin a gradual return to play protocol. A return to play protocol is started when a clinician believes the athlete is asymptomatic and ready to get back into their sport activities. It is a gradual five-step progression, increasing in activity and physical contact. If the athlete completes the protocol while staying asymptomatic, they are given medical clearance. They did not find a significant difference in symptom recovery between the three groups ($p=0.182$) (Hoffman et al., 2020). Of note, the sleep duration tracked did not include naps or sleep during the day. Sleep disturbances during the night could result in daytime sleepiness and napping.

These studies suggest disturbances in sleep has an effect on prolonging recovery time from SRC. Each study utilized a different means to measuring sleep disturbance/quality. In addition, while each study assessed for recovery time, these studies did not control for other factors that could influence recovery time. For example, work by Cassimatis and colleagues and

Forrest et al., suggests patients with a delay in the initial evaluation significantly prolonged recovery from SRC (Cassimatis et al., 2021; Forrest et al., 2018). Specifically, Cassimatis et al. (2021) found patients who were evaluated late (>28 days) took three times longer to recover than patients who were evaluated early (<14 days) (Cassimatis et al., 2021). In contrast, Chung et al. (2019) included patients with date of injuries up to 180 days from their initial evaluation.

OBJECTIVES

The primary aim of this practicum was to examine the association between the presence of a sleep modifier at the initial evaluation CCPS and recovery time from SRC in preadolescent, adolescent, and young adults. Recovery times were compared between those with a sleep modifier at the initial evaluation and those without a modifier to see if there is a significant difference between the presence/absence of a sleep modifier. Recovery time was calculated as the total number of days between the date of injury and the date of clearance. This practicum also sought to quantify differences in recovery time between those with and without a sleep modifier. We also examined the total number of days between date of injury and initial evaluation and assessed for significance. We evaluated the incidence rate ratio of the sleep modifier on recovery time while controlling for other potential factors of prolonged recovery. Since sleep disturbance could interfere with the body's recovery post-SRC and prolong recovery times, one might expect to find greater recovery times with the presence of a sleep modifier in a patient's CCPS (Kontos et al., 2019; Meier et al., 2020; Piantino et al., 2022). Supporting findings of Kontos et al. (2019) *we hypothesize the presence of a sleep modifier significantly prolongs recovery time from SRC compared to the absence of modifiers in our sample.*

SIGNIFICANCE

SRCs are mild traumatic brain injuries that disrupts normal cognitive functioning in the brain. The incidence rate of SRC is estimated to be 1.6 million to 3.8 million cases annually in the U.S. alone. With the impact that SRCs and sleep disturbances have on cognitive performance, it is beneficial for clinicians and patients to understand the severity and impact of poor sleep quality on recovery. As problems with obtaining good quality sleep is found in 30-70% of SRC patients, it is important to quantify the impact sleep disturbances have on recovery time (Kontos et al., 2019).

METHODS

Our study was approved by the Baylor Scott & White Research IRB Red under the Baylor Scott & White Sports Therapy & Research Umbrella Protocol (020-290). The population sampled for this retrospective medical record review included all patients who received treatment at the Baylor Scott and White (BSW) Sports Concussion Program in the BSW Sports Therapy and Research building at The Star in Frisco, Texas from August 2019 to December 2021. Data from patient records were transferred onto the online secure database, Research Electronic Data Capture (REDCap), and included: demographic data for age and sex, concussion and medical history, injury details, and CCPS. There were no age limitations for this study. Regarding the CCPS, only the initial evaluation was examined and was differentiated based on the presence or absence of a sleep modifier. Inclusion criteria included – initial evaluation within 30 days of injury, diagnosed with a SRC, completion of CCPS, and completion of treatment at the clinic. Exclusion criteria included – the absence of a CCPS, non-sports-related concussion, patients with incomplete records, date of injury occurred >30 days from the initial evaluation. Patients who

presented with a neck/cervical modifier at the initial evaluation were also excluded. This included patients who presented with both a neck/cervical modifier and a sleep modifier. As both are CCPS modifiers, the inclusion of patients with a neck/cervical modifier could skew the data.

The analyzed were the presence of sleep modifiers at initial evaluations and recovery times. The presence of sleep modifiers was determined after the completion of the CCPS questionnaire. The sleep modifier average scores were also examined.

STATISTICS

Sample characteristics were described using descriptive statistics. Frequencies and percentages were used to describe categorical variables. A chi-square test was used to test for associations between categorical variables. Because our data was asymmetrical, medians and interquartile ranges (IQR) were used to describe continuous variables. A Wilcoxon rank-sum test was used to test for differences in continuous variables between modifier groups. A negative binomial regression was used to assess the relationship between the length of treatment in days and the presence of a sleep modifier while adjusting for statistically and clinically significant variables. All statistical analyses were performed using Statistical Analysis System (SAS) 9.4 with a significance level of 0.05.

RESULTS

There were 486 patient records collected between August 2019 and December 2021. Of these, 141 patients met the inclusion criteria and were grouped based on the presence or absence of a sleep modifier during their initial evaluation CCPS into a no modifier (NM) group and a sleep modifier (SM) group.

Patient demographic information can be found in Table 1. Patient concussion and medical history can be found in Table 2. Patient injury details are described in Table 3.

Multivariate regression is described in Table 1.

There were 69 patients in the NM group and 72 patients in the SM group. The median ages were 15.6 (13.9, 17.3) and 15.3 (14.6, 16.6) respectively. The median age in the sample was 15.4 (14.3, 17.1). The age ranges were 9-22 years in the NM group and 8-24 years in the SM group. There were more males (53.9%) than females (46.1%) in this sample. There was a significant sex difference with more females in the SM group (n=41, 56.9%) than in the NM group (n=24, 34.8%) ($p=0.0083$).

Table 2: Patient demographics

	All (n=141)	No Modifiers (n=69)	Sleep Modifier (n=72)	p-value
Age, median (IQR)	15.4 (14.3, 17.1)	15.6 (13.9, 17.3)	15.3 (14.6, 16.6)	0.7918
Age range	8 – 24	9 – 22	8 – 24	
Sex, n patients (%)				0.0083
Male	76 (53.9%)	45 (65.2%)	31 (43.1%)	
Female	65 (46.1%)	24 (34.8%)	41 (56.9%)	

Personal history of concussion and number of previous concussions were assessed for significance. There was no significant difference found between the NM and SM groups.

Research on factors for prolonged recovery from SRC is still ongoing. Current evidence suggests that a history of migraine (personal/family), personal histories of anxiety/depression, ADHD, and learning disability are factors of prolonged recovery from SRC (Martin et al., 2022; Rosenbaum et al., 2020). As a result, these pre-morbid factors were assessed in our sample and no significance was found between the two groups.

Table 3: Concussion and medical history

Histories, <i>n patients (%)</i>	All (n=141)	No Modifiers (n=69)	Sleep Modifier (n=72)	p-value
Personal History of Concussion				0.8559
No	93 (66.0%)	45 (65.2%)	48 (66.7%)	
Yes	48 (34.0%)	24 (34.8%)	24 (33.3%)	
Number of Previous Concussions	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)	0.9449
0	93 (66.0%)	45 (65.2%)	48 (66.7%)	
1	34 (24.1%)	19 (27.5%)	15 (20.8%)	
2	10 (7.1%)	4 (5.8%)	6 (8.3%)	
3	2 (1.4%)	0 (0.0%)	2 (2.8%)	
5	1 (0.7%)	1 (1.4%)	0 (0.0%)	
6	1 (0.7%)	0 (0.0%)	1 (1.4%)	
History of Migraine (personal or family)				0.1129
No	87 (61.7%)	38 (55.1%)	49 (68.1%)	
Yes	54 (38.3%)	31 (44.9%)	23 (31.9%)	
Personal History of Anxiety/Depression				0.0680
No	126 (89.4%)	65 (94.2%)	61 (84.7%)	
Yes	15 (10.6%)	4 (5.8%)	11 (15.3%)	
Personal History of ADHD				0.8524
No	126 (89.4%)	62 (89.9%)	64 (88.9%)	
Yes	15 (10.6%)	7 (10.1%)	8 (11.1%)	
Personal History of a Learning Disability				0.9331
No	127 (90.1%)	62 (89.9%)	65 (90.3%)	
Yes	14 (9.9%)	7 (10.1%)	7 (9.7%)	

There was no significance between the two groups in time from injury to evaluation.

There was a significant difference ($p=0.0001$) in symptom recovery time between the two groups. The NM group had a median recovery time of 14 days (11, 21) while the SM group had a median time of 20.5 days (14, 29.5). Presence of vestibular clinical profiles were also examined as vestibular clinical profiles are associated with prolonged recovery time from SRC and no significance was found in our sample (Kontos et al., 2017).

Table 4: Injury details

	All (n=141)	No Modifiers (n=69)	Sleep Modifier (n=72)	p-value
Time from injury to evaluation (days); median (IQR)	3 (1, 6)	3 (1, 6)	2 (2, 5)	0.4561
Recovery time (days from injury to clearance); median (IQR)	16 (13, 25)	14 (11, 21)	20.5 (14, 29.5)	0.0001
Primary CP, n patients (%)				
Not Vestibular	130 (92.2%)	66 (95.7%)	64 (88.9%)	0.1344
Vestibular	11 (7.8%)	3 (4.4%)	8 (11.1%)	
Sleep Modifier Average Score (Initial visit) (N=140); median (IQR)	0.3 (0, 0.8)	0 (0, 0)	0.6 (0.5, 1)	<0.0001

A negative binomial regression was used to assess the relationship between recovery time (from injury to clearance) and the presence of a sleep modifier while adjusting for risk factors of prolonged recovery – vestibular primary CP, history of migraine, and personal history of anxiety and/or depression (Kontos et al., 2017; Rosenbaum et al., 2020). Adjusting for those factors, the presence of a sleep modifier significantly increased the length of recovery – this resulted in a recovery length that was 1.45 times the length of recovery in patients without a modifier ($p < 0.0001$).

Table 4: Multivariate regression

	Incidence Rate Ratio	95% Confidence Interval	p-value
Sleep modifier	1.4498	(1.2097, 1.7375)	<0.0001
Vestibular Primary CP	1.0459	(0.7492, 1.4601)	0.7917
History of Migraine (personal or family)	1.1672	(0.9706, 1.4036)	0.1003
Personal History of Anxiety/Depression	0.9766	(0.7316, 1.3036)	0.8724

DISCUSSION

Kontos et al. (2019) examined the influence of sleep as a modifier for concussion outcomes. Their paper showed that the presence of a sleep modifier may negatively impact and/or exacerbate the concussion clinical profiles and therefore negatively impact recovery. This practicum sought to support their results and quantify differences in recovery time between those with and without a sleep modifier.

The primary aim of our work was to examine the association between the presence of the CCPS sleep modifier and recovery time in athletes following SRC. The data support the hypothesis, and the presence of a sleep modifier in the CCPS was significantly associated with greater symptom recovery time in concussed athletes. Patients with a sleep modifier in the initial evaluation were found to have a median recovery time 6.5 days longer than patients who did not have a sleep modifier. Adjusting for other factors that could have an impact on recovery time (i.e., vestibular primary CP, history of migraines, and personal history of anxiety/depression) using negative binomial regression analysis, the presence of a sleep modifier in the initial evaluation resulted in a 45% longer recovery time compared to the absence of the CCPS modifier. While using a different means to assess for sleep disturbances, the findings support previous studies which suggest sleep disturbances increase recovery times from SRC.

The CCPS was introduced with its seminal paper by Kontos et al. in 2020. They ran their own study comparing the concurrent validity of the CCPS with other tools with their concussed athlete sample (n=121, 12-19 years) with an average age of 18.83 years (SD 10.29). Comparatively, our concussed athlete sample (n=141, 8-24 years) had a median age of 15.4 year

s (IQR 14.3, 17.1). Study participants completed the CCPS along with other concussion symptom inventory tools (Post-Concussion Symptom Scale (PCSS), Vestibular/Ocular-Motor Screening (VOMS), and ImPACT) at their initial evaluation following SRC. VOMS assesses for vestibular and ocular function. ImPACT is a neurocognitive symptom assessment test. A positive correlation of 0.83 was found ($p < 0.001$) between the CCPS sleep modifier and PCSS sleep factor. This is likely due to the two tools sharing the same sleep questions, with the CCPS having a different sleep question (*difficulty staying asleep*) instead of “drowsiness.” They differ in severity scale as the CCPS is 0-3 and the PCSS is 0-6, albeit they use the same word scale. The CCPS uses a four-point scale based on “None,” “Mild,” “Moderate,” and “Severe” symptom ratings. The PCSS uses the same symptom rating, but on a seven-point scale (0 = None, 1-2 = Mild, 3-4 = Moderate, 5-6 = Severe). The other two symptom tools (VOMS and ImPACT) assessed and listed by Kontos et al. have no sleep assessments.

There was a significant sex difference in our sample, with the SM group having 22.1% more females ($p = 0.0083$). This could affect the recovery time reported in the SM group according to a systematic review by Iverson et al. on predictors of clinical recovery from concussion. While the current literature on the effect of sex on recovery is not completely clear, it leans towards females having a longer recovery (Iverson et al., 2017). Sex differences in neck strength, injury biomechanics, and injury rates were considered to be possible reasons why (Iverson et al., 2017). However, recent research looking into the effects of sex differences in recovery time in adolescent males and females suggests hormonal differences are attributable to longer recovery times (Gallagher et al., 2018). This could influence the significant difference in recovery time.

Due to the patient population of the clinic, a majority of the sample was in middle or high school (91.5%) also represented by the median sample age being 15.4 years old. There was no age limitation due to a concern there would not be enough patients for analysis if a limitation was put in place. The age range of our sample was 8-24 years. The age range for this sample is broader than the age range sampled by Kontos et al. (2020) at 12-19 years. The median age of our participants was 15.4 years (IQR 14.3, 17.1) compared to the average age of participants (18.83 years, SD 10.29) sampled by Kontos et al. (2020). The wider age range of our sample could introduce variability in recovery time as research points towards the younger a patient is the longer the recovery time (Henry & Sandel, 2015).

The median time from injury to initial evaluation in our sample was 3 days (*IQR* 1, 6). The median time from injury to initial evaluation in the NM and SM groups was 3 days (*IQR* 1,6) and 2 (*IQR* 2, 5), respectively and with no significance being found. Patients with initial evaluations done more than 30 days from their date of injury were excluded from the sample, due to evidence indicating a delay in the initial evaluation significantly prolonged recovery from SRC (Cassimatis et al., 2021; Forrest et al., 2018). Patients with neck CP screen modifiers were excluded following the same logic with research suggesting neck complications following SRC indicate prolonged recovery (Provance et al., 2020).

There were some limitations to this study. One limitation regarding not controlling for all factors of prolonged recovery time – a few of them being on-field dizziness, worsening of symptoms from date of injury to initial evaluation, and if a patient returned to play after being injured and for how long they continued to play for. So, while there was a significant difference in recovery times between the two groups, it is difficult to say for certain that the presence of a sleep modifier was indicative of prolonged recovery without controlling for the other factors.

Another limitation would be related to behavioral recommendations to improve sleep provided to the patients by the clinician. After the initial evaluation, patients are provided with behavioral recommendations to adjust behaviors (i.e., lessen screen time, no daytime napping, etc.) and help with recovery. Whether or not patients are compliant with the behavioral recommendations could drastically affect recovery time. A possible limitation to this research proposal is selection bias. The data used was only sourced from the BSW Sports Concussion Program located in Frisco, Texas. Therefore, the sample population being from Frisco, Texas and the surrounding cities may not be representative of the general population. Adolescent athletes make up a large majority of the patient population at the clinic. Therefore, while there was not an age restriction for this study, the sample consisted of predominantly adolescents with 91.5% of the sample being in middle or high school. Self-report bias is also possible due to possible confusion, uncertainty, and wanting to return to play faster.

CONCLUSIONS

This research suggests that the presence of a sleep modifier at the initial evaluation CCPS leads to prolonged recovery time from SRC in a sample consisting of preadolescent, adolescent, and young adult athletes. This supports Kontos et al. (2019) on how sleep is a negative modifier of SRC. Patients who self-reported having sleeping disturbances through the CCPS and presented with a sleep modifier at the initial evaluation had a longer recovery time than patients who presented with no modifiers on the CCPS. To understand the degree of how much sleep disturbances play a role in prolonging recovery time requires a thorough and controlled analysis as there are many pre- and post-morbid factors that could affect recovery time from SRC.

This study expands on the impact SRCs have and factors that impede recovery. It also expands on the usage of the CCPS and the usage of the CCPS sleep modifier as a potential indicator for prolonged recovery time from SRC in preadolescent, adolescents, and young adults. Further research looking into the association between sleep disturbances and recovery time from SRC should control for pre-morbid, post-morbid factors, and compliance to behavioral recommendations that could influence recovery time. With age being a pre-morbid factor that could influence recovery time from SRC, future research should have an age limitation. Additionally, the future research should compare recovery times for different values of CCPS sleep modifier average scores to examine if there is a positive correlation between these parameters.

REFERENCES

- Babcock, L., Byczkowski, T., Wade, S. L., Ho, M., Mookerjee, S., & Bazarian, J. J. (2013). Predicting postconcussion syndrome after mild traumatic brain injury in children and adolescents who present to the emergency department. *JAMA Pediatr*, *167*(2), 156-161. <https://doi.org/10.1001/jamapediatrics.2013.434>
- Bramley, H., Henson, A., Lewis, M. M., Kong, L., Stetter, C., & Silvis, M. (2017). Sleep Disturbance Following Concussion Is a Risk Factor for a Prolonged Recovery. *Clin Pediatr (Phila)*, *56*(14), 1280-1285. <https://doi.org/10.1177/0009922816681603>
- Cassimatis, M., Orr, R., Fyffe, A., & Browne, G. (2021). Early injury evaluation following concussion is associated with improved recovery time in children and adolescents. *J Sci Med Sport*, *24*(12), 1235-1239. <https://doi.org/10.1016/j.jsams.2021.06.012>
- CDC. (2010). *Facts about Concussion and Brain Injury: Where to Get Help*. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. Retrieved March 4 from https://www.cdc.gov/headsup/pdfs/providers/facts_about_concussion_tbi-a.pdf
- Center of Disease Control and Prevention. (2016, December 9, 2021). *Traumatic Brain Injury & Concussion*. Retrieved March 4 from <https://www.cdc.gov/traumaticbraininjury/index.html>
- Chung, J. S., Zynda, A. J., Didehbani, N., Hicks, C., Hynan, L. S., Miller, S. M., Bell, K. R., & Cullum, C. M. (2019). Association Between Sleep Quality and Recovery Following Sport-Related Concussion in Pediatrics. *J Child Neurol*, *34*(11), 639-645. <https://doi.org/10.1177/0883073819849741>
- Collins, M. W., Kontos, A. P., Reynolds, E., Murawski, C. D., & Fu, F. H. (2014). A comprehensive, targeted approach to the clinical care of athletes following sport-related concussion. *Knee Surg Sports Traumatol Arthrosc*, *22*(2), 235-246. <https://doi.org/10.1007/s00167-013-2791-6>
- Eisenberg, M. A., Meehan, W. P., 3rd, & Mannix, R. (2014). Duration and course of post-concussive symptoms. *Pediatrics*, *133*(6), 999-1006. <https://doi.org/10.1542/peds.2014-0158>
- Forrest, R. H. J., Henry, J. D., McGarry, P. J., & Marshall, R. N. (2018). Mild traumatic brain injury in New Zealand: factors influencing post-concussion symptom recovery time in a specialised concussion service. *J Prim Health Care*, *10*(2), 159-166. <https://doi.org/10.1071/HC17071>
- Gallagher, V., Kramer, N., Abbott, K., Alexander, J., Breiter, H., Herrold, A., Lindley, T., Mjaanes, J., & Reilly, J. (2018). The Effects of Sex Differences and Hormonal Contraception on Outcomes after Collegiate Sports-Related Concussion. *J Neurotrauma*, *35*(11), 1242-1247. <https://doi.org/10.1089/neu.2017.5453>
- Goel, N., Rao, H., Durmer, J. S., & Dinges, D. F. (2009). Neurocognitive consequences of sleep deprivation. *Semin Neurol*, *29*(4), 320-339. <https://doi.org/10.1055/s-0029-1237117>
- Henry, L. C., & Sandel, N. (2015). Adolescent Subtest Norms for the ImpACT Neurocognitive Battery. *Appl Neuropsychol Child*, *4*(4), 266-276. <https://doi.org/10.1080/21622965.2014.911094>
- Hoffman, N. L., Weber, M. L., Broglio, S. P., McCrea, M., McAllister, T. W., Schmidt, J. D., & Investigators, C. C. (2020). Influence of Postconcussion Sleep Duration on Concussion

- Recovery in Collegiate Athletes. *Clin J Sport Med*, 30 Suppl 1, S29-S35.
<https://doi.org/10.1097/JSM.0000000000000538>
- Irwin, M. R. (2019). Sleep and inflammation: partners in sickness and in health. *Nat Rev Immunol*, 19(11), 702-715. <https://doi.org/10.1038/s41577-019-0190-z>
- Iverson, G. L., Gardner, A. J., Terry, D. P., Ponsford, J. L., Sills, A. K., Broshek, D. K., & Solomon, G. S. (2017). Predictors of clinical recovery from concussion: a systematic review. *Br J Sports Med*, 51(12), 941-948. <https://doi.org/10.1136/bjsports-2017-097729>
- Kontos, A. P., Deitrick, J. M., Collins, M. W., & Mucha, A. (2017). Review of Vestibular and Oculomotor Screening and Concussion Rehabilitation. *J Athl Train*, 52(3), 256-261. <https://doi.org/10.4085/1062-6050-51.11.05>
- Kontos, A. P., Elbin, R. J., Trbovich, A., Womble, M., Said, A., Sumrok, V. F., French, J., Kegel, N., Puskar, A., Sherry, N., Holland, C., & Collins, M. (2020). Concussion Clinical Profiles Screening (CP Screen) Tool: Preliminary Evidence to Inform a Multidisciplinary Approach. *Neurosurgery*, 87(2), 348-356. <https://doi.org/10.1093/neuros/nyz545>
- Kontos, A. P., Sufrinko, A., Sandel, N., Emami, K., & Collins, M. W. (2019). Sport-related Concussion Clinical Profiles: Clinical Characteristics, Targeted Treatments, and Preliminary Evidence. *Curr Sports Med Rep*, 18(3), 82-92. <https://doi.org/10.1249/JSR.0000000000000573>
- Kostyun, R. O., Milewski, M. D., & Hafeez, I. (2015). Sleep disturbance and neurocognitive function during the recovery from a sport-related concussion in adolescents. *Am J Sports Med*, 43(3), 633-640. <https://doi.org/10.1177/0363546514560727>
- Malhotra, R. K. (2017). Sleep, Recovery, and Performance in Sports. *Neurol Clin*, 35(3), 547-557. <https://doi.org/10.1016/j.ncl.2017.03.002>
- Martin, A. K., Petersen, A. J., Sesma, H. W., Koolmo, M. B., Ingram, K. M., Slifko, K. B., Nguyen, V. N., Doss, R. C., & Linabery, A. M. (2022). Learning and Attention Deficit/Hyperactivity Disorders as Risk Factors for Prolonged Concussion Recovery in Children and Adolescents. *J Int Neuropsychol Soc*, 28(2), 109-122. <https://doi.org/10.1017/S1355617721000229>
- Mayo Clinic. (2020, February 17 2022). *Concussion: Symptoms and causes*. Mayo Clinic Foundation for Medical Education and Research. Retrieved March 4 from <https://www.mayoclinic.org/diseases-conditions/concussion/symptoms-causes/syc-20355594>
- Meier, T. B., Huber, D. L., Bohorquez-Montoya, L., Nitta, M. E., Savitz, J., Teague, T. K., Bazarian, J. J., Hayes, R. L., Nelson, L. D., & McCrea, M. A. (2020). A Prospective Study of Acute Blood-Based Biomarkers for Sport-Related Concussion. *Ann Neurol*, 87(6), 907-920. <https://doi.org/10.1002/ana.25725>
- Nitta, M. E., Savitz, J., Nelson, L. D., Teague, T. K., Hoelzle, J. B., McCrea, M. A., & Meier, T. B. (2019). Acute elevation of serum inflammatory markers predicts symptom recovery after concussion. *Neurology*, 93(5), e497-e507. <https://doi.org/10.1212/WNL.00000000000007864>
- Philip, P., Taillard, J., Sagaspe, P., Valtat, C., Sanchez-Ortuno, M., Moore, N., Charles, A., & Bioulac, B. (2004). Age, performance and sleep deprivation. *J Sleep Res*, 13(2), 105-110. <https://doi.org/10.1111/j.1365-2869.2004.00399.x>
- Piantino, J. A., Iliff, J. J., & Lim, M. M. (2022). The Bidirectional Link Between Sleep Disturbances and Traumatic Brain Injury Symptoms: A Role for Glymphatic

- Dysfunction? *Biol Psychiatry*, 91(5), 478-487.
<https://doi.org/10.1016/j.biopsych.2021.06.025>
- Provance, A. J., Howell, D. R., Potter, M. N., Wilson, P. E., D'Lauro, A. M., & Wilson, J. C. (2020). Presence of Neck or Shoulder Pain Following Sport-Related Concussion Negatively Influences Recovery. *J Child Neurol*, 35(7), 456-462.
<https://doi.org/10.1177/0883073820909046>
- Rosenbaum, P. E., Locandro, C., Chrisman, S. P. D., Choe, M. C., Richards, R., Pacchia, C., Cook, L. J., Rivara, F. P., Gioia, G. A., & Giza, C. C. (2020). Characteristics of Pediatric Mild Traumatic Brain Injury and Recovery in a Concussion Clinic Population. *JAMA Netw Open*, 3(11), e2021463. <https://doi.org/10.1001/jamanetworkopen.2020.21463>
- Rutland-Brown, W., Langlois, J. A., Thomas, K. E., & Xi, Y. L. (2006). Incidence of traumatic brain injury in the United States, 2003. *J Head Trauma Rehabil*, 21(6), 544-548.
<https://doi.org/10.1097/00001199-200611000-00009>

CHAPTER III

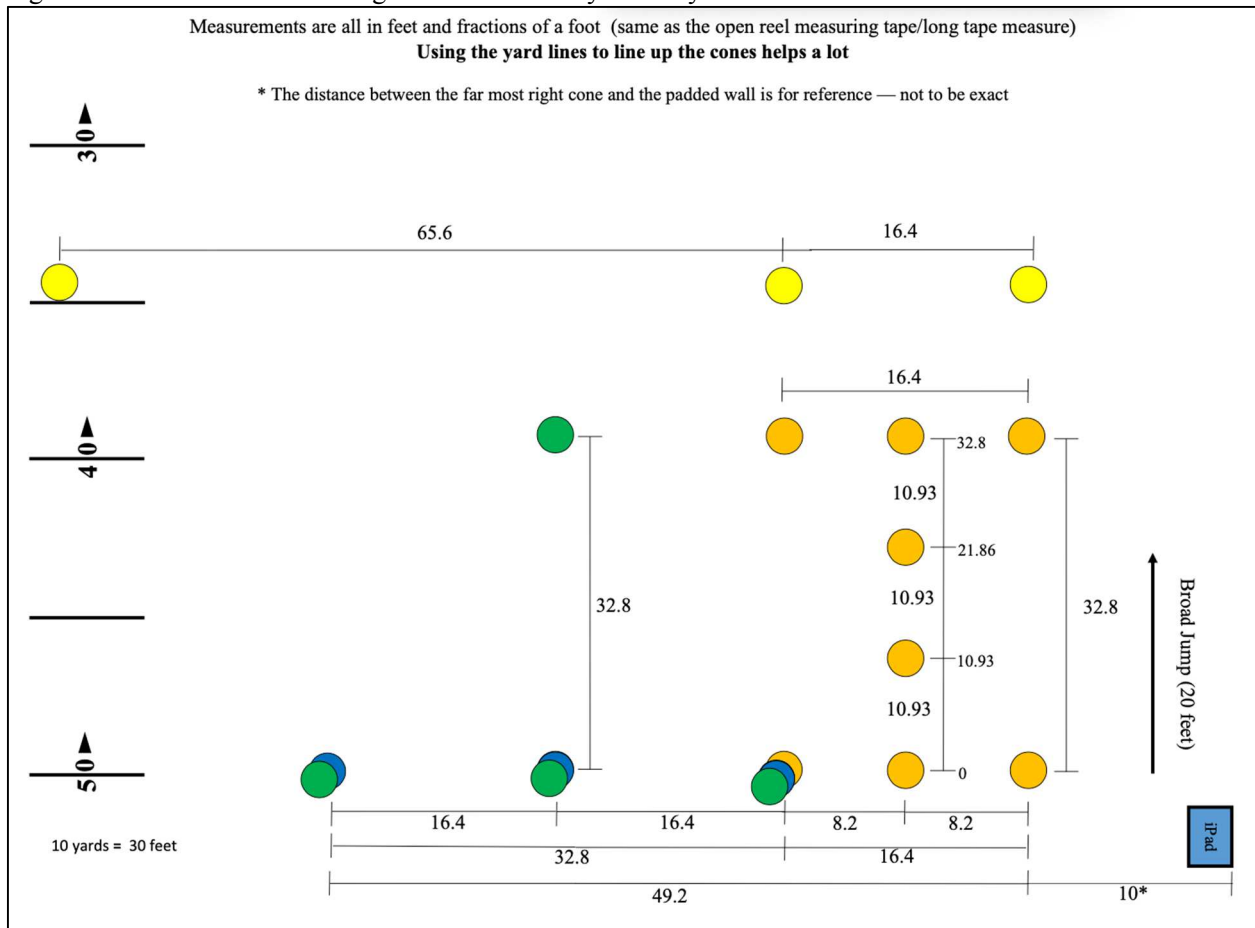
INTERNSHIP EXPERIENCE

My research internship experience was completed at the Baylor Scott & White (BSW) Sports Therapy and Research at The Star in Frisco, Texas. The Star at Frisco, Texas is the home of the NFL team, the Dallas Cowboys Headquarters, and their practice facility. It is also home to the Ford Center and BSW Sports Therapy & Research. The BSW Sports Therapy and Research building encompass a plethora of healthcare and athletic performance services. My internship was completed with the BSW Sports Therapy and Research team.

My internship was held between June 1st 2021 and April 8th 2022. At the start of my internship, I learned about clinical research and various clinical research coordinator responsibilities. I also picked up the responsibility to run Sports Academy's Journal Club for interns each semester, this entailed presentations and keeping track of interns and their assignments. The research team's Mask Phase 2 study was ongoing during this time. The Mask Phase 2 study looked into the differences in cognitive performance and VO₂max (maximum oxygen consumption during physical performance) among participants with cloth face masks and without. After completing CITI training, I was able to help with the study. It was through this study, that I first learned about the informed consent process, data collection, and data entry into REDCap, a secure online database. Concurrent with the Mask Phase 2 study, I also had the

opportunity to perform phone interviews with participants of the Greater Lifestyle Balance/Cerebrovascular Accident (GLB/CVA) study and help them schedule their follow-up. The GLB/CVA study was a 12-month study examining the efficacy of the GLB program for weight loss amongst patients following stroke. After the Mask Phase 2 study, we began an exertion study. The purpose of the exertion study was to create and test an exercise protocol for concussed athletes with the goal of decreasing their recovery time and bringing them back to play sooner than traditional treatment. The exertion study consisted of an exercise circuit with four facets in aerobic, anaerobic, strength, and agility exercises. I reviewed the literature surrounding sub-symptom threshold heart rate exercise in recovering from concussion. Based on the exercises, I designed a cone layout graphic for the exertion study to assist in aligning the various cones for each exercise (Fig. 4).

Figure 2 – BSW Concussion Program Exertion study cone layout



For the phase 1 trial, I arranged the cones on the turf field, set up equipment, received the informed consent from healthy participants, collected trial data, cleaned up equipment, and entered data into REDCap.

During my internship, I had an opportunity to reviewed literature for a grant application for a healthy lifestyle program for TBI patients (GLB-TBI+) utilizing a mobile/web-based application. I created ClinicalTrials.gov applications and registered listings for the new K5 Validation and COVID Exercise studies. The K5 validation study compared the utilization of the newer K5 metabolic system with the older, gold-standard Parvo metabolic cart in measuring gas intake and flow during a cardiopulmonary exercise test. The COVID exercise study investigated the effect of an exercise training program on the functional, emotional, and cognitive health of

adults with symptoms of long COVID. When the K5 validation study started, I received informed consent from participants, collected data, and entered data into REDCap. Throughout my internship, I have transferred concussion patient data from EPIC's electronic health record (EHR) into a concussion registry on REDCap. I transferred 240 patients records from the EPIC EHR into the REDCap database. I assisted with preparing for the official audit by Lisa from BSW's data auditing for the Mask phase 2 study and audited the concussion registry.

I have done various activities and office tasks throughout my internship experience. I helped assemble silicon face masks used for exercise testing. I have helped dry Parvo metabolic cart respiratory tubes. I have managed the printer and its supplies. I descaled the office coffee maker. I have helped with moving and arranging various things in the office and for a firefighter's rehab/exercise drill test. Overall, I had a very positive experience during my internship being a part of the BSW Sports Therapy and Research team.

JOURNAL SUMMARY

Chol Ho James Kim – Weekly Journals
BSW Sports Therapy & Research Intern

Tuesday, June 1st, 2021

After arrival I was taken to the room the team performed the Phase 1 of their mask study as well as the room, they will be having their Phase 2 study in. The Phase 2 of the study was to be done through a stationary bicycle. Dr. Driver, the PI for the study, was doing a practice run on the bike to ensure the equipment was working. I watched Dr. Driver bike as well as was introduced to everything related to the room and personnel by Taylor, a clinical research coordinator. Taylor introduced me to various clinical research applications as well as procedures. She also introduced me to various important people in the building. She walked me through the New Employee binder and explained everything in it. I worked on onboarding tasks until the end of the day.

Wednesday, June 2nd, 2021

I worked on onboarding tasks as well today. I was having trouble with getting access to certain Baylor Scott & White applications, so I spent an hour talking with the IT helpdesk. Completed CITI trainings required as per the New Employee Reference Manual. Met with another intern, Yana, along with Taylor and walked around the building as she introduced the facilities to her. Had a meeting with Evan and talked about future plans for my internship. Continued to work on onboarding tasks until the end of the day.

Thursday, June 3rd, 2021

Arrived early to shadow Taylor as we had a clinical research participant at 8am. Watched Taylor go through the consent process and questions with the participant. Due to a screening failure, she could not participate in the study. Finished reading ICH as part of the onboarding. Walked with Taylor and Katelyn to a coffee shop. Went through the case report form for a different study with Katelyn and Taylor that we will be training for tomorrow. Watched an IRB review through an online conference call. Worked on CRM program stuff, sent out 1st committee meeting email. Talked with Christa Ochoa from downtown to schedule shadowing.

Friday, June 4th, 2021

Participant scheduled today is late so there was some downtime. Completed Conflict of Interests form sent by BSW. Met study participant with Taylor and Katelyn, shadowed and watched them go through the consent process and protocol. Helped out with different small tasks. Had a meeting with led by Evan and Taylor regarding a different study that me and other interns can help with. Meeting with Marshall along with Taylor over Journal Club. Watched a presentation given on the field organized by Sports Academy and other organizations for first responders with Yana.

Monday, June 7th, 2021

Worked on Journal Club presentations and talked with Marshall about JC plans. Attended Star Research Team Meeting. Prepared for Mock GLB/CVA interviews with Evan. Met with Evan and talked about my time here as well as talked about my thesis preparation. Mock GLB/CVA interview with Evan.

Tuesday, June 8th, 2021

Mask study participants scheduled for today rescheduled so a lot of downtime. Did research about concussions in preparation for meeting later with Dr. Reynolds. Brainstorming for thesis. Walked through concussion database entry in REDCap with Taylor. Met with Dr. Reynolds and Dr. Covert to talk about her program and my thesis. Worked on Journal Club presentation.

Wednesday, June 9th, 2021

Prepared for Journal Club meeting. Ran through the presentation with Taylor. Held intro to Journal Club meeting with Taylor helping. Brainstormed for thesis question. Worked through last onboarding learning modules on PeoplePlace. Helped Taylor with preparing her gift cards for study reimbursements.

Thursday, June 10th, 2021

Attended BSW Focused Employee Orientation.

Friday, June 11th, 2021

Completed PeoplePlace onboarding learning modules. Researched and brainstormed for thesis question. Shadowed Taylor along with Yana as she worked as a coordinator for the mask study. Called participants of GLBCVA project, leaving voicemails and logging communications.

Monday, June 14th, 2021

Shadowed Dr. Reynolds in the Sports Concussion Clinic. Afterwards, shadowed Taylor in a study trial with a participant. Called IT to get printing to work on the BSW computer. Had lunch with a prospective BSW hire. Shadowed Taylor again for another participant, learning responsibilities of her job. Brainstormed about thesis proposal and prepared study participant folders for tomorrow.

Tuesday, June 15th, 2021

Starting to take data collection for the study. Had three study participants today. Prepared for thesis proposal and PowerPoint presentation. Worked on Journal Club presentation preparation. Prepared study folders for tomorrow's study participants.

Wednesday, June 16th, 2021

Did a practice presentation for my thesis proposal and Journal Club class and received feedback. Mask participants scheduled for the day either canceled & rescheduled or did not show up. Journal Club at noon, going over the ketogenic diet. Worked on thesis proposal.

Thursday, June 17th, 2021

Prepared study folders for tomorrow's participants. There were no mask study participants scheduled so focused and worked on thesis proposal as I had it scheduled for today at 4pm. Thesis proposal presentation, fixed and resent a document as well as sent out an email to Dr. Reynolds to ask about her input for thesis.

Friday, June 18th, 2021

Three study participants scheduled for today. Taking over more responsibilities – going through the case report form with participants as well as continuing to write down data retrieved during the exercise and cognitive assessment. Looked through literature to find more information on sleep data. Second participant came in, I COVID-screened him, and Evan performed informed consent. I went through the case report form as well as wrote down the data retrieved during the exercise and cognitive assessments. Last study participant scheduled canceled so prepared study folders for Monday's participants and looked through literature for sleep studies in regard to anxiety/mood and concussions.

Monday, June 21st, 2021

There was an 8AM participant study today, collected data for the trial. Talked with Evan and Taylor about my thesis proposal topic. Emailed Dr. Mathew and Dr. Reynolds – getting clarification from Dr. Mathew about deadlines and scheduling a meeting with Dr. Reynolds to discuss potential topics for my thesis proposal. There was a 10AM participant in which Evan consented and I took care of the rest – COVID screening, administered CRF, collected data, and asked post-exercise questions. Sat in the Star Research Team meeting. There was a 2PM participant – I COVID screened, asked them questions, collected exercise data, and asked them post-exercise and post-trial questions. Did a practice informed consent with Taylor and received feedback. I prepared the study folders for tomorrow.

Tuesday, June 22nd, 2021

Met with Michelle Acker online to go through a mock informed consent check-off at 8:30AM and was successful and written off. Did a little bit of last-minute researching in preparation for my meeting with Dr. Reynolds at 1PM. There was a participant at 10AM – I COVID screened them, questioned them, collected data, and asked them post-exercise and post-trial questions. There was a study participant at 12PM – I COVID screened them and questioned them, however, because of my meeting with Dr. Reynolds, Taylor took over and completed the rest of the responsibilities. Did a little bit more of last-minute researching and met with Dr. Reynolds to discuss potential topics for my thesis proposal. Sat in on a Mask Continuing Review call. Met with my major professor, Dr. Stankowska, updating her and receiving advice about the program and the internship. Prepared study participant folders for the next day.

Wednesday, June 23rd, 2021

The study participants scheduled for 8am and 12pm did not show. Texted today's and tomorrow's participants. Learned REDCap data entry from Taylor – watched her enter data for a study participant and then she watched me enter data for a study participant. The team went through and planned for a new study on the field – I watched and held laptops for their convenience. After getting back, I entered data for one participant on my own and she checked it off. Emailed Dr. Driver and Dr. Reynolds to

finalize my thesis proposal idea. There was a 2pm study participant – COVID screened them, informed consented them, questioned them, collected data from the exercise trial, and questioned them post-trial. Received feedback from Megan. Uploaded the journal article for Journal Club and emailed the interns. Prepared the folders for tomorrow with Evan's help.

Thursday, June 24th, 2021

Texted today's participants. There was an 8am participant – COVID screened them, informed consented them, questioned them, collected trial data, and asked them post-trial questions. Texted tomorrow's study participants. Inputted data into REDCap for a few participants. Emailed Dr. Driver and Dr. Reynolds to finalize my thesis proposal idea. Emailed the rest of the committee. Made folders for tomorrow and blank complete folders for future participants. There was a 2pm participant – COVID screened them, informed consented them, questioned them, collected trial data, and asked them post-trial questions. Texted a new participant for tomorrow, used one of the blank folders I made earlier today for their folder. Emailed Michelle the remaining documents she required. Did data entry into REDCap for one participant.

Friday, June 25th, 2021

Arrived at 7:30am – helped with set up for our 8am, however, the Cosmed K5 device's software was corrupted so it could not calibrate properly. This caused us to cancel and reschedule all of our study participants for the day as Katelyn needed to go out to buy a SD card in order to reinstall the software for the K5. With the free time, I prepared the folders for next week and checked the folders for data entry. Worked with Yana to prepare more blank complete folders. Completed the PeoplePlace EPIC training modules. Left at 3pm.

Monday, June 28th, 2021

Attended a team meeting. There was a 10am participant – COVID screened them & asked them questions regarding their perception of wearing masks during exercise. I did not prepare in advance for the Journal Club presentation run through with Dr. Driver, so Taylor took over for the data collection part as I spent the time preparing for it. Did a presentation run through with Dr. Driver and Taylor for feedback to ensure I feel confident and prepared for the Journal Club presentation on Wednesday. Afterwards I got to have lunch and then I entered data into REDCap. I met with Taylor to talk about how things have been going as well as to-dos and my thesis. I continued to enter data into REDCap and then helped Katelyn clean up in the diagnostic lab. Planned for research proposal with Taylor. Worked on research proposal and clerical work until the end of the day.

Tuesday, June 29th, 2021

Arrived a little before 9am – texted today's and tomorrow's participants a reminder. Helped set up diagnostic lab for the 10am participant. Worked on research proposal rough draft until the participant arrived – COVID screening them, informed consented them, went through the CRF with them, and collected data for the exercise trial. Helped clean up the diagnostic lab and brought back equipment. Worked on

research proposal rough draft. Entered today's participant data into REDCap. Back to working on research proposal rough draft. Taylor trained me on concussion data entry – ran into some technical difficulties with the EPIC client as her EPIC client seems to be on a different version than mine but after some time, I figured it out. After being able to pull up a patient treatment log, we found out I did not have access to open patient treatment logs. Responded back to Michelle – signed the research consent process & check off form and sent it back to her. Cleaned the coffee drip tray and checked tomorrow's participant's folder.

Wednesday, June 30th, 2021

Texted today's and tomorrow's participants a reminder. Worked on Journal Club presentation. Finalized email about primary aim and hypothesis to Dr. Driver and Dr. Reynolds and sent email. Went outside to the turf with team to practice and take photos for the upcoming exertion study. Presented Journal Club 2 over a sleep article. Helped set up the diagnosis lab. Helped put together the K5 silicone masks and disinfect them. Had a participant at 2pm – COVID screened them and then asked them questions regarding their view on wearing masks during exercise. Composed an assignment and attendance log for the Sports Academy interns with Journal Club. Prepared and checked participants folder for the remainder of the week.

Thursday, July 1st, 2021

Texted today's participant a reminder. Helped with diagnosis lab setup. 8am participant – COVID screened them, questioned them about their attitudes on wearing face masks during exercise, collected data for trial exercise, and asked post-trial questions. Sat in on a training meeting on Teams. Helped clean up and pack the diagnosis lab, took out some cardboard to the recycling area with the help of Mr. Greyer (the security guard). Called IT about Windows Defender notification. Worked on research proposal. Checked folders for tomorrow. Left early to work on proposal at home.

Friday, July 2nd, 2021

The 8am participant canceled so I worked on my research proposal. Helped out Katelyn with preparing the K5 masks. Worked on research proposal. Because SA was renovating the space we have our diagnosis lab in, we decided to move everything into the classroom. Worked on research proposal. 10am participant came in – COVID screen them, asked them questions, collected data, and asked them post-survey questions. Worked on UNTHSC stuff. 2pm participant came in – COVID screened them, informed consented them, questioned them over demographics, clinical and physical activity information, collected data, and questioned them over attitudes over face coverings. Worked on UNTHSC stuff. Entered REDCap data. Cleaned desk.

Monday, July 5th, 2021

Independence Day observed, everyone was off.

Tuesday, July 6th, 2021

Arrived at 0900, there was a 10am participant but they had to reschedule. Texted today's participant and tomorrow's participants. Set up diagnosis lab. Taylor trained me

in data entry into REDCap for the concussion clinic. We had a meeting regarding the Phase 3 trial of the mask study and I took notes. Our 2pm participant came in a bit early so I COVID screened them, asked the attitudes towards face coverings during exercise questionnaire and then talked with them for a while. Helped finish setting up the diagnosis equipment. Texted another participant about receiving their reminder instruction email. Collected data for the 2pm participant trial and asked post-study questions. Helped clean up the diagnosis equipment. Entered data into REDCap for completed mask study participants. Planned for tomorrow.

Wednesday, July 7th, 2021

Arrived at 0845, texted today's participants and got my laptop set up for the 9am team meeting to type notes and have it on the big screen. Helped set up equipment, called the 10am participant but no response – ended up not showing. Talked with Taylor about Journal Club, sent out email for next Journal Club meeting and article. I transferred patient records from EPIC to REDCap for the concussion clinic. 12pm participant texted they arrived – COVID screened them, informed consented them, questioned them, collected trial data, and asked them post-exercise questions. Ran through exertion study set-up by myself on the field.

Thursday, July 8th, 2021

Arrived at 0645, Mr. Greyer let me in the classroom. Texted today's participant and moved the exertion equipment out onto the field with the help of Mr. Greyer. Sorted cones by color and placed cones on field. Watched Katelyn and Taylor run through the exertion study with Kayla as the participant. Cleaned up field and brought equipment back to classroom. Helped set up equipment for mask study. 10am participant arrived – COVID screened them, informed consented them, questioned them, collected data while holding onto the Cosmed K5 device, and asked them post-trial questions. Ran through REDCap questions and intro to the exertion REDCap with Taylor and Katelyn.

Friday, July 9th, 2021

Arrived at 0740 – brought some equipment to Katelyn as she was setting up in the Sports Academy gym on the 1st floor. Collected data for CPET. Cleaned and brought back equipment to the classroom. 10am participant came in early so COVID screened, informed consented them, questioned them, collected data, and asked them post-trial questions. Did data entry. 2pm participant came – COVID screened them, collected trial data, and asked post-study questions. Continue to data entry for mask study and concussion study.

Monday, July 12th, 2021

Arrived at 7:35, helped set up the equipment downstairs for the participant as we were doing the trial on treadmill in the first-floor gym. Collected data for participant trial. Worked on PowerPoint presentation for Journal Club. Continued to work on PowerPoint presentation. Had lunch before participant came in, however, participant rescheduled. Went through one of the data entries I made with Taylor for quality check. Finished last week's weekly journal and left early.

Tuesday, July 13th, 2021

Arrived at 7:50 as our 8am had rescheduled because they reported to be sick. Worked on data entry for concussion program until lunch. Continued to work on data entry for concussion program. Worked on some Journal Club stuff. Left at 1500.

Wednesday, July 14th, 2021

Arrived at 9 as the only event scheduled is Journal Club 3 presentation/meeting. Had a short meeting with Marshall to talk about Journal Club and the interns. I went through the PowerPoint presentation. Rehearsed and edited presentation until JC3 meeting – had discussions with the discussion questions and then went over the presentation. Met with Evan for a brief moment talking about how the internship is going. Worked on data entry for the concussion program.

Thursday, July 15th, 2021

Texted tomorrow's participant. Worked on research proposal rough draft edits and sent them back to major professor. Prepared tomorrow's participant's folder. I went through UNTHSC learning modules. Helped movers bring a shipment from Dallas into the diagnostic room. Worked on data entry for the concussion program.

Friday, July 16th, 2021

Worked on remaining UNTHSC learning modules. Quality checked my data entries for the concussion program with Taylor. Continued and completed UNTHSC learning modules while. Quality checked the rest of my data entries.

Monday, July 19th, 2021

Sanitized desk and prepared tomorrow's participant's folder & texted them. Sat in the weekly team meeting. Worked on data entry for the concussion program for a majority of the day. Helped set up the testing area for tomorrow's participant.

Tuesday, July 20th, 2021

Texted 8am participant and helped set up equipment. 8am participant came – COVID screened them, informed consented them, asked them questions from the case report form, collected exercise trial data, and asked post-trial questions. Helped clean/sanitize and created a PowerPoint slide for tomorrow's group activity. Continued to transfer concussion program data. Helped rearrange tables for tomorrow's event.

Wednesday, July 21st, 2021

Rehab/ST&R Team building at The STAR today. Prepared tomorrow's participant's folder. Continued to transfer concussion program data into REDCap.

Thursday, July 22nd, 2021

Texted tomorrow's participants and prepared folders. Helped Katelyn count supplies received a week ago. Continued to transfer concussion program data into REDCap.

Friday, July 23rd, 2021

Worked on edits from committee member over my research proposal rough draft. 12pm participant came with their friend – gave them a tour of Sports Academy. COVID screened them, ran through the questionnaire with them, collected trial data, and asked post-trial questions. Did data entry for the mask study.

Monday, July 26th, 2021

Helped set up for the 8am participant, prepared their folder. Once they texted their arrival, met with them, COVID screened them, filled out one sheet of paperwork, and asked them one questionnaire. Took them inside the study room, collected exercise trial data, and asked them post-trial questions. Sat in the Star's weekly team meeting. Talked with Oliver about shadowing me. Met with Taylor to talk about my progress with my research proposal. Helped clean up equipment. Worked on REDCap entries for the mask study, checking and filling incompletes. Filled out journal for today.

Tuesday, July 27th, 2021

Sat in Exertion study meeting at 0930 and had to step out for a Zoom meeting with my major professor and a committee member professor discussing my revised research proposal. Edited my research proposal and sent it off to my committee. Filled out a form that goes with my research proposal and sent it to my major professor. Read Journal Club article and went through the PowerPoint presentation for tomorrow.

Wednesday, July 28th, 2021

Prepared for Journal Club 4 presentation and edited PowerPoint. Held the Journal Club 4 meeting. Went through all of the folders for the phase 2 mask study and checked for completion/status. Entered data into REDCap for two participants.

Thursday, July 29th, 2021

Transferred data for concussion registry into REDCap. Audited a folder as part of the 10% audit done for the phase 2 mask study. Corrected data entries for REDCap and CRFs. Printed off documents in preparation of exertion study. Worked on concussion registry data entry.

Friday, July 30th, 2021

Took the day off for camping trip.

Monday, August 2nd, 2021

Printed out exertion study screeners for Megan. Prepared participant folder for today's afternoon participant. Transferred patient data from EPIC to REDCap for the concussion registry. Continued to transfer patient data from EPIC to REDCap for the concussion registry. Prepared equipment for the afternoon mask study participant. Actively recruited participants for the upcoming exertion study by walking around with Yana and talking with parents waiting on their kids (kids were participating in soccer camp). Had a 2:30pm participant, COVID screened them, informed consented them, asked them questions about their experience with COVID illness, and collected patient trial data.

Tuesday, August 3rd, 2021

Responded to emails. Fixed a form my committee requires. Continued to transfer patient data from EPIC to REDCap for the concussion registry. Quality checked concussion registry entries and wrote down my questions for Taylor to go through with her later. Continued to transfer patient data.

Wednesday, August 4th, 2021

Attended a Baylor Institute of Research Orientation.

Thursday, August 5th, 2021

Sent out Journal Club 5 email and reminder to the Sports Academy interns. Talked about work from home procedures. Transferred patient data from EPIC to REDCap for the concussion registry. Went through the question list I made for Taylor. Continued to transfer patient data from EPIC to REDCap.

Friday, August 6th, 2021

Arrived late because I had an 8am appointment at the UNTHSC Student Clinic to check out my left big toe to see if I fractured it. Went through all of the participant folders for the mask study to check if everything is in order. Transferred patient data from EPIC to REDCap for the concussion registry. Helped rearrange tables and then connected the electricity cords to get power to each table.

Saturday, August 7th, 2021 [0750 - 1500] 7:10

Laid out cones for the exertion study's first participant.

Monday, August 9th, 2021 [0830 - 1530] 7:00

Worked from home. Edited my page on Microsoft Notebook. Attended team meeting. Looked through literature over concussion and sleep. Edited my research proposal. Attended exertion screening training. Studied the exertion study protocol and wrote a manuscript for myself. Read Journal Club article 5 in preparation for JC5 presentation on Wednesday.

Tuesday, August 10th, 2021 [0800 - 1600] 8:00

Worked on data transfer from EPIC to REDCap for the concussion registry for the entire day.

Wednesday, August 11th, 2021 [0910 - 1740] 8:30

Edited Journal Club 5 PowerPoint presentation and reviewed Journal Club article 5. Worked on data transfer from EPIC to REDCap for the concussion registry until presentation at noon. Held Journal Club meeting. Responded to emails. Continued to work on data transfer from EPIC to REDCap. Reviewed consent and assent forms for exertion training tomorrow.

Thursday, August 12th, 2021 [0845 - 1700] 8:15

Worked on transferring data for concussion registry. Got trained on the assent process for the exertion therapy study. Continued to work on transferring data and listened in on the COVID-19 Exertion Study meeting.

Friday, August 13th, 2021

Called IT – trying to get VPN to work. I need to wait on the security administrator to grant access. Made a rough plan on how I want to approach formatting my research proposal. Completed the first week of “Writing in the Sciences.”

Monday, August 16th, 2021

Updated my notebook page for the 10am research team meeting. Edited and printed off communication logs for Megan. Sat in research team meeting. Contacted Steve about VPN access and called IT helpdesk for updates. Prepared for debrief meeting with Marshall and planned for the next intern cohort and what to do for Journal Club moving forward. Worked on concussion registry data transfer. Prepared folder for tomorrow’s exertion therapy participant.

Tuesday, August 17th, 2021

Helped bring down exertion therapy study equipment and set up on the turf field on the first floor. Arranged colored cones. Assisted in set up and data collection when needed. Had two participants at 9am and 11am. Copied documents for both. Edited the cone setup illustration. Met with Taylor for weekly meeting. Discussed being comfortable with the exertion therapy study process. Went through concussion registry questions with Taylor.

Wednesday, August 18th, 2021

Worked on concussion registry data transfer, from EPIC to REDCap the whole day. Updated the reg. binder with the revised documents for the exertion therapy study.

Thursday, August 19th, 2021

Worked from home today. Reviewed the exertion therapy protocol. Had a training appointment at UNTHSC IREB at 10am. Worked on concussion registry data transfer. Worked out. Continued to work on data transfer for the concussion registry.

Friday, August 20th, 2021

Worked on concussion registry data transfer for the majority of the day. Attended a team meeting covering the procedure for starting new studies. Attended the graduation ceremony for the Sports Academy summer cohort. Celebrated Taylor’s birthday. Continued to work on concussion registry data transfer.

Monday, August 23rd, 2021

Updated premade blank folders that were made in-advance for exertion therapy study. Updated my Notebook page. Attended weekly team meeting. Continued to work on concussion registry data transfer from EPIC to REDCap. Completed catching up and is now up to date. Worked through “Writing in the Sciences” Week 2 class.

Tuesday, August 24th, 2021

Finished Week 2 of “Writing in the Sciences.” Prepared for the informed consent process for the exertion therapy study. Wrote notes for the exertion therapy study informed consent process. Watched videos over the informed consent process.

Wednesday, August 25th, 2021

Worked on literature review for Kayla’s exertion therapy study.

Thursday, August 26th, 2021

Worked from home. Worked on literature review for Kayla’s exertion therapy study.

Friday, August 27th, 2021

Worked on literature review for Kayla’s exertion therapy study. Went through concussion registry questions with Taylor. Worked with Taylor to create a barebones skeleton case report form for a new study, COVID-19 Exercise study that Katelyn is leading.

Monday, August 30th, 2021

Updated my notebook. Attended the weekly meeting. Worked on literature review for Kayla’s exertion study. Reviewed the exertion therapy informed consent form. Worked on data transfer for concussion registry.

Tuesday, August 31st, 2021

Worked from home today. Worked on literature review for Kayla’s exertion study. Attended team meeting for COVID Exercise study led by Katelyn. Worked on creating a CRF form for the COVID Exercise study.

Wednesday, September 1st, 2021

Breakfast with the new orthopedic resident Dr. Jonathan Dawkins – introducing everyone to him and getting to know him. Prepared folders for upcoming Exertion study participants. Worked on CRF for the new COVID Exercise study. Met with Katelyn and Taylor to talk about the CRF and questions I had making the CRF. Edited CRF according to meeting discussion. Sent completed rough draft of CRF for review to Katelyn and Taylor. Worked on concussion registry, continuing to update.

Thursday, September 2nd, 2021

Worked from home. Worked on UNTHSC CRM Professional Development class. Worked on literature review for Kayla’s exertion study. Planned for Journal Club introduction/article presentations.

Friday, September 3rd, 2021

Continued to work on literature review for Kayla’s exertion study. Continued to work on concussion registry.

Monday, September 6th, 2021

Labor Day – BSWH Holiday

Tuesday, September 7th, 2021

Worked from home. Worked on UNTHSC CRM Professional Development modules. Worked on literature review for Kayla's exertion study. Worked on Journal Club planning.

Wednesday, September 8th, 2021

Worked on concussion registry data transfer. Attended Star Research Meeting. Worked on literature review for Kayla's exertion study. Worked on CRF for COVID Exercise.

Thursday, September 9th, 2021

Worked from home. Worked on UNTHSC CRM Professional Development modules. Worked on preparing and recording Sport's Academy's Journal Club introduction presentation.

Friday, September 10th, 2021

Prepared folder for tomorrow's exertion study participant. Worked on literature review for Kayla's exertion study. Worked on adding emotional assessment questionnaires onto the COVID Exercise CRF. Continued to work on literature review.

Monday, September 13th, 2021

Worked on the concussion registry – catching up to current date, transferring data from medical records to REDCap. Attended weekly team meeting. Completed the literature review for Kayla's Exertion study. Worked on edits for the COVID Exercise study's case report form.

Tuesday, September 14th, 2021

Worked on the COVID Exercise study case report form led by Katelyn – completing edits and format changes. Worked on edits for the case report form for the K5 Validation study led by Katelyn.

Wednesday, September 15th, 2021

Made a few small edits to the COVID Exercise study case report form. Emailed the new cohort of Sports Academy interns introducing myself and linking them to a YouTube video I made covering Journal Club. Worked on concussion registry data entry. I sat in on a virtual seminar "Focus on Research" highlighting BSW orthopedic surgeons' latest research and findings around hip-spine syndrome and the association with abnormal hip biomechanics. Continued to work on concussion registry data entry. Helped with technical difficulties for a virtual meeting.

Thursday, September 16th, 2021

Edited participant folder for today to match dates for the gift card. Worked on concussion registry data transfer. Prepared more participant folders for new screened

participants and made more blank folders for future participants. Continued to work on concussion registry. Helped set up field for exertion before heading out.

Friday, September 17th, 2021

Worked on Journal Club 1 – Nutrition presentation and presentation script.
Recorded presentation.

Monday, September 20th, 2021

Updated my notebook page in lieu of today's team meeting. Attended team meeting. Prepared multiple participant folders for screened participants in the exertion study. Made edits to the COVID exercise CRF. Reviewed exertion study documents in preparation for assessing participants Thursday.

Tuesday, September 21st, 2021

Reviewed exertion study documents in preparation. Went through exertion study document questions with Taylor. Continued to study exertion study documents. Attended online BSW North Texas Staff Meeting. Made edits on the COVID exercise case report form per Taylor's review comments. Sent email to Marshall talking about the Journal Club 1 session. Worked on concussion registry data transfer into REDCap.

Wednesday, September 22nd, 2021

Sat in mask study phase 2 results discussion. Replaced previous version patient screener with updated page. Reviewed and studied exertion study documents. Worked on concussion registry data transfer from EPIC to REDCap. Laid out equipment for exertion study in preparation for today's participant. Informed consented and wrote down data obtained during the study trial. Packed equipment.

Thursday, September 23rd, 2021

Changed clothes from volunteering to work clothes. Sent replies to SA interns for Journal Club 1 discussions. Entered data into REDCap for yesterday's exertion study participant. Laid out equipment for exertion study in preparation for today's participant. Informed consented and assented, wrote down data obtained during the study trial. Ran Dr. Dawkins through the exertion study trial. Entered participant data into REDCap.

Friday, September 24th, 2021

Worked from home. Worked on Journal Club presentation 2.

Monday, September 27th, 2021

Worked on data transfer for the concussion registry. Attended weekly team meeting. Continued to work on data transfer. Laid out exertion study equipment before leaving.

Tuesday, September 28th, 2021

Worked on data transfer for the concussion registry. Met with Taylor to talk about my internship and received guidance for the exertion study and my thesis project. Continued to work on data transfer for the concussion registry.

Wednesday, September 29th, 2021

Had a going away breakfast party for Dr. Dawkins, the orthopedic surgery resident we had with us for a month. Attended virtual town hall meeting. Prepared blank folders for exertion study. Continued to work on data transfer for the concussion registry. Laid out equipment for the exertion study in preparation for the 4pm participant.

Thursday, September 30th, 2021

Arrived at noon because there's a participant at 6pm. Worked on concussion registry data transfer. Laid out equipment for exertion study in preparation for the 6pm participant early. Reviewed participant facing documents. Informed consented and data collected for the exertion study participant. Cleaned up equipment. Sat in "Elevate with Evidence" meeting.

Friday, October 1st, 2021

Worked from home. Worked on Journal Club presentation. Recorded Journal Club 2 presentation and uploaded to YouTube.

Monday, October 4th, 2021

Reviewed information over manuscript formatting. Worked on CRM Professional Development module 3. Worked on concussion registry data transfer. Laid out equipment for the participant at 4pm. Waited for the participant to show up – ended up not showing. Cleaned up equipment.

Tuesday, October 5th, 2021

Inputed exertion study participant data into REDCap for the previous participants. Worked on concussion registry data transfer into REDCap. Put the borrowed table from yesterday's setup back into the storage. Reconnected electricity cables for the tables. Continued to work on concussion registry data transfer. Answered potential participant phone calls from parents.

Wednesday, October 6th, 2021

Sent out email to Sports Academy interns regarding due date for this week's Journal Club. Worked on concussion registry data transfer until grant planning meeting. Sat in grant planning meeting – Dr. Driver talked about the fundamentals of grant writing as we went through last year's grant for the GLB study. Afterwards, we all decorated our team's pumpkin in preparation for the upcoming Monday's pumpkin competition. Continued to work on concussion registry data transfer until the ISM student that will be with us until next year arrived. Taylor led a brief orientation for her, and I showed her the Sports Academy space and introduced her to the Sports Academy people we met along the way. Showed her the facilities and cognition application Sports Academy utilize. Continued to work on concussion registry data transfer. Drafted and sent email to tomorrow's participant. Prepared folders for future participants. Responded back to tomorrow's participant's reply to my email.

Thursday, October 7th, 2021

Volunteered at vaccine clinic from 0630 to 1030 so arrived at 1100. Prepared folder for future participant. Reviewed last year's grant application. Worked on Journal Club week 2 stuff – reviewed interns discussions, tracked participation, and emailed debriefed Marshall. Read information regarding research over sleep, deep wave sleep's cleaning function, and Alzheimer's disease.

Friday, October 8th, 2021

Worked from home. Read and reviewed last year's grant application. Took notes over the grant application.

Saturday, October 9th, 2021

Was planning to make up for hours today with the scheduled exertion study participant but they canceled Friday evening.

Monday, October 11th, 2021

Helped out Kayla with moving her pumpkin from her car to the classroom. Checked today's participant folders to make sure they were prepared. Met and talked with a Sports Academy intern regarding Journal Club. Sent out emails to Sports Academy interns that weren't participating in Journal Club. The Research Team held the 2nd Annual Pumpkin Decorating Contest – socializing and eating breakfast foods. Talked with one of the Sports Academy people for a while – going over my history, internship experience so far, previous study data, and etc. Laid out equipment for today's exertion study participants while talking to Sports Academy interns – explaining the purpose of the exertion study, research studies in the works, and sleep and concussion research. Of the three participants scheduled for today, informed consented all three participants, entered participant study data into REDCap for two of the three participants today, and recorded cognitive data for one of the participants.

Tuesday, October 12th, 2021

Worked on CRM Professional Development Module 3. Printed out more Exertion study screeners and communication logs for Taylor. Entered yesterday's exertion study's participant data into REDCap. Prepared more blank folders for future exertion study participants. Updated Weekly Journals. Worked on REDCap data transfer for the concussion registry.

Wednesday, October 13th, 2021

Sat in Grant planning meeting – split responsibilities for literature review. Took pictures for a new study – K5 validation study. Transferred data for concussion registry. Sat in MedTrials "Reporting and Coding Safety Events" webinar. Continued to transfer data for concussion registry. Laid out equipment for today's exertion study participants. Once participant arrived, informed consented, made copies of documents, collected data, and cleaned up equipment as the next participant had canceled their appointment. Entered today's participant study data into REDCap before leaving.

Thursday, October 14th, 2021

Uploaded Journal Club article to Trello. Did literature review for GLB-TBI grant. Met with Taylor to talk about my internship so far and progress. Laid out equipment for today's exertion study participant. Participant came in a little early – informed consented, assented, collected data, and cleaned up. iPad stand was a little broken, so I fixed it. Entered today's participant study data into REDCap until 6pm as they started maintenance.

Friday, October 15th, 2021

Finished entering yesterday's participant study data into REDCap. Worked on Journal Club 3 presentation, writing script, and preparing for when I can record the video presentation. Laid out exertion study equipment for today's participant. Informed consented, printed out copies of patient documents, collected study data, and cleaned up exertion study equipment.

Sunday, October 17th, 2021

Worked on and recorded Journal Club 3 presentation.

Monday, October 18th, 2021

Sent out Journal Club 3 presentation video to Sports Academy interns. Worked on concussion registry data transfer until Dr. Liz Teel, a research scientist prospective hire, came into the office. Sat in lunch meeting and presentation by Dr. Teel. Continued to work on concussion data transfer.

Tuesday, October 19th, 2021

Was at BUMC today for Ekso meeting at 12pm. With the help of Jamie, a research PT, I got to shadow Radha and Lauren as they were helping their patients. Got to ask them questions and get to see what an in-patient physical therapist hospital setting looked like. Got to see a patient unable to walk use the Ekso exoskeleton to walk around the first floor.

Wednesday, October 20th, 2021

Marked intern participation for Journal Club 3 and sent out reminder emails. Prepared exertion study participant folders. Worked on concussion registry data transfer. Sat in Dr. Driver's "Focus on Research – Innovation and Collaboration at BSWRI." Continued to work on concussion registry data transfer.

Thursday, October 21st, 2021

Took the day off today.

Friday, October 22nd, 2021

Received a new laptop to use in replacement of the tablet I was using. Spent the majority of the day transferring data and making sure I transferred everything that I needed from the previous device. Laid out exertion study equipment for the new PT resident that will be working with Kayla. Watched the PT resident go through the circuit. Cleaned up the equipment. Prepared participant folders for Monday's participants.

Monday, October 25th, 2021

Sat in weekly team meeting. Helped set up equipment for Katelyn as she tested a firefighter through exercises. Met with Taylor and talked about thesis and future studies. Texted today's participants and laid out exertion study equipment. After participants arrived, COVID screened them, informed consented them, made copies of documents, and collected study trial data. Helped cleaned up equipment.

Tuesday, October 26th, 2021

Worked from home.

Wednesday, October 27th, 2021

Marked Sports Academy intern participation in Journal Club 3. Uploaded the JC4 article and emailed the interns introducing the article and reminded them of deadlines. Transferred Monday's exertion study participant trial data into REDCap. Worked on creating a ClinicalTrials.gov listing for the new COSMED K5 Validation study that is starting soon. Transferred data for concussion registry. Entered data for a STAR Potential Participant REDCap so that we can pull previous study participants who indicated interest in future studies.

Thursday, October 28th, 2021

Worked from home – worked on the Journal Club 4 presentation, preparing and recording presentation. Attended online webinar for “Advanced GCP.”

Friday, October 29th, 2021

Worked on STAR Potential Participant REDCap database – transferred Mask Phase 1 participants. Sat in the First Responders convention Sports Academy was hosting. Transferred data for the concussion registry.

Monday, November 1st, 2021

Sat in weekly team meeting. Worked on literature search over MedGem vs Parvo metabolic system comparisons. Worked on concussion registry data transfer from EPIC to REDCap. Went through Mask Phase 2 participant folders who never showed up and recycled papers. Laid out equipment for today's participant, informed consented, collected data, and cleaned up equipment.

Tuesday, November 2nd, 2021

Out of office – participating in research study on campus.

Wednesday, November 3rd, 2021

Worked on concussion registry data transfer. Sat in weekly grant meeting. Continued to work on concussion registry data transfer.

Thursday, November 4th, 2021

Worked on grant literature review. Worked on concussion registry data transfer. Laid out exertion equipment.

Friday, November 5th, 2021

Worked from home.

Monday, November 8th, 2021

Worked on data entry into REDCap for concussion registry. Prepared for today's participant. Laid out exertion equipment. Informed consented and collected data for participant study visit. Cleaned up equipment.

Tuesday, November 9th, 2021

Worked from home.

Wednesday, November 10th, 2021

Worked on data entry into REDCap for concussion registry. Sat in MedTrials webinar. Continued to work on data entry for concussion registry.

Thursday, November 11th, 2021

Worked on thesis all day.

Friday, November 12th, 2021

Worked from home.

Monday, November 15th, 2021

Entered data into REDCap for Saturday's CASE study participants. Laid out CASE equipment for media participants. Checked mailbox. Sent out email for Journal Club. Filled out the QA log for Saturday's CASE study participants. Started the PASC/COVID exercise PRS application.

Tuesday, November 16th, 2021

Completed the PASC/COVID exercise PRS application. Literature review for the GLB-TBI+ grant. Went through two MedTrials modules. Transferred data into REDCap for concussion registry.

Wednesday, November 17th, 2021

Typed out weekly journal. Sat in Grant meeting. Worked on literature review and writing for grant. Worked on edits for K5 PRS application before submitting for review by Dr. Driver.

Thursday, November 18th, 2021

Moved stationary exercise bike to the field for today's news reporter as they are doing a story over the mask study. Left early due to health concerns.

Friday, November 19th, 2021

Recovery day.

Monday, November 22nd, 2021

Transferred patient data from EPIC to REDCap for concussion registry. Made and organized digital files in preparation for K5 validation study folders. Made KVAL folders for upcoming participants. Met with Taylor to talk about internship progress and thesis progress. Entered data for future participant REDCap registry. Cleaned and descaled office Nespresso machine.

Tuesday, November 23rd, 2021

Sent out email for Journal Club 5. Bond movie day. Entered data for future participant REDCap registry.

Wednesday, November 24th, 2021

Baylor recognized Thanksgiving Break.

Thursday, November 25th, 2021

Baylor recognized Thanksgiving Break.

Friday, November 26th, 2021

Baylor recognized Thanksgiving Break.

Monday, November 29th, 2021

Prepared KVAL folder for today's participant. Worked on grant application. Prepared KVAL folder for a new participant.

Tuesday, November 30th, 2021

Prepared KVAL folder for a new participant. Worked on grant application. Helped Katelyn with the Parvo cart setup for the K5 validation study. Worked on data transfer for concussion registry.

Wednesday, December 1st, 2021

Sat in Grant meeting. Worked on data transfer for concussion registry.

Thursday, December 2nd, 2021

Worked on data transfer for concussion registry. Consented a study participant for the K5 validation study. Continued to work on data transfer.

Friday, December 3rd, 2021

Recovery day from COVID booster.

Monday, December 6th, 2021

Sat in weekly team meeting. Dried breathing tubes used in the K5 validation study. Worked on grant application for GLBTBI+. Prepared folders for screened study participants for the K5 validation study.

Tuesday, December 7th, 2021

Helped Taylor go through gift cards. Worked on grant application for GLBTBI+. Helped Taylor do an audit for the Exertion study. Continued to work on grant application for GLBTBI+.

Wednesday, December 8th, 2021

Met with Marshall to debrief over this cohort's Journal Club. Worked on grant application for GLBTBI+.

Thursday, December 9th, 2021

Worked on grant application for GLBTBI+. Worked on data transfer for concussion registry.

Friday, December 10th, 2021

Worked on thesis – outcome measures. Entered data for STAR potential participants REDCap database.

Monday, December 13th, 2021

Holiday party with white elephant gift exchange and brunch. Worked on data transfer for concussion registry.

Tuesday, December 14th, 2021

Out of office.

Wednesday, December 15th, 2021

Worked from home.

Thursday, December 16th, 2021

Sent emails for school. Entered data for K5 validation study into REDCap. Prepared today's participant folder for K5 validation study. Transferred data for concussion registry into REDCap. Helped Katelyn with today's participant.

Friday, December 17th, 2021

Transferred data for concussion registry into REDCap.

Monday, December 20th, 2021

Out of office.

Tuesday, December 21st, 2021

Out of office.

Wednesday, December 22nd, 2021

Out of office.

Thursday, December 23rd, 2021

Out of office.

Friday, December 24th, 2021

Out of office.

Monday, December 27th, 2021

Out of office.

Tuesday, December 28th, 2021

Out of office.

Wednesday, December 29th, 2021

Out of office.

Thursday, December 30th, 2021

Out of office.

Friday, December 31st, 2021

Out of office.

Monday, January 3rd, 2022

Due to potential COVID exposure, could not go into office until cleared by Employee Health. Worked on my thesis from home.

Tuesday, January 4th, 2022

Worked on thesis from home.

Wednesday, January 5th, 2022

Worked on thesis from home.

Thursday, January 6th, 2022

Worked on thesis from home.

Friday, January 7th, 2022

Worked on thesis from home.

Monday, January 10th, 2022

Worked on thesis from home.

Tuesday, January 11th, 2022

Worked on thesis from home.

Wednesday, January 12th, 2022

Worked on thesis from home.

Thursday, January 13th, 2022

Worked on thesis from home. EH called me and I received return-to-work clearance to work from home. However, due to allergy symptoms I needed a EH nurse to call and clear me for return-to-office.

Friday, January 14th, 2022

Worked on thesis from home. EH nurse called me and cleared me for return-to-work.

Monday, January 17th, 2022

Sat in team meeting. Entered participant data into REDCap for K5 Validation study. Checked all entries for K5 validation study with participants' CRFs. Talked with Marshall about the new Sports Academy intern cohort and Journal Club. Met with Taylor and talked about the thesis project – expectations and what I need to work on. Worked on finalizing my list of variables that may prolong symptom recovery to control for. Sent out emails.

Tuesday, January 18th, 2022

Prepared for morning participant. Informed consented and collected data for participant study visit. Entered participant data into REDCap. Transferred folders from a file cabinet to a lockable file cabinet in preparation for tomorrow's event. Sent out emails. Worked on Journal Club introduction presentation for tomorrow.

Wednesday, January 19th, 2022

Worked on Journal Club introduction presentation edits. Could not meet with interns for Journal Club due to them being busy + space being occupied. Sent out emails. Continued to work on introduction presentation.

Thursday, January 20th, 2022

Worked on closing out concussion patient file records on REDCap. Collected data for today's afternoon K5 validation participant. Entered data into REDCap. Continued to work on closing patient file records on REDCap. We had an evening participant for K5 validation study – informed consented and collected data for participant.

Friday, January 21st, 2022

Worked on thesis from home.

Monday, January 24th, 2022

Emailed Sports Academy interns about Journal Club. Entered K5 validation study data into REDCap. Checked exertion study documents for BSW internal audit tomorrow.

Tuesday, January 25th, 2022

Sent out immunization records for UNTHSC. Sat in a virtual COVID seminar. Added more files onto the potential participants REDCap database.

Wednesday, January 26th, 2022

Added more files into the potential participants REDCap database. Sat in Orthosurgery resident research presentation. Continued to add more files into the potential participants REDCap database. Sat in on "Improving Sleep Through Mindfulness and Meditation" webinar by BSW.

Thursday, January 27th, 2022

Worked from home.

Friday, January 28th, 2022

Worked from home.

Monday, January 31st, 2022

Worked from home. Sat in Star team research meeting. Updated ClinicalTrials PRS applications. Created and worked on Journal Club presentations.

Tuesday, February 1st, 2022

Sent out emails for Journal Club. Entered data for K5 validation study into REDCap. Worked on thesis.

Wednesday, February 2nd, 2022

Logged Sports Academy intern participation for Journal Club. Helped Katelyn move equipment down to the field for her work with a firefighter rehabilitation. Watched the session. Cleaned up and moved the equipment back into the office.

Thursday, February 3rd, 2022

Stayed home due to winter storm. Worked on thesis.

Friday, February 4th, 2022

Stayed home due to winter storm. Worked on thesis.

Monday, February 7th, 2022

Sat in team meeting. Made edits to current study CRFs. Emailed SA interns about research study opportunity. Met with Taylor to talk about updates and thesis. Resent intent to defend form. Worked on thesis.

Tuesday, February 8th, 2022

Worked from home on thesis.

Wednesday, February 9th, 2022

Worked on Journal Club 1 recap and start of Journal Club 2. Made edits to the STAR Potential Participant REDCap database. Worked on thesis.

Thursday, February 10th, 2022

Worked from home due to car transmission failure.

Friday, February 11th, 2022

Worked from home due no transportation.

Monday, February 14th, 2022

Worked from home due to no transportation.

Tuesday, February 15th, 2022

Worked from home due to no transportation.

Wednesday, February 16th, 2022

Worked on thesis. Audited concussion registry for dates. Sat in research webinar.
Continued to work on thesis.

Thursday, February 17th, 2022

Worked on thesis. Met with Taylor to talk about thesis progress. Continued to work on thesis. Rounded with Evan to talk about internship, thesis, future plans.

Friday, February 18th, 2022

Worked from home on thesis. Sent Taylor rough draft.

Monday, February 21st, 2022

Sat in weekly team meeting. Worked on thesis. Met with Taylor to talk about thesis. Helped arrange classroom for upcoming days where SA will be using the classroom space.

Tuesday, February 22nd, 2022

Worked from home as SA is using classroom space. Worked on thesis. Met with Kendall to talk about the statistics report and to clarify terms.

Wednesday, February 23rd, 2022

Worked from home as SA is using classroom space as well as inclement weather.
Worked on thesis.

Thursday, February 24th, 2022

Worked from home due to inclement weather. Worked on abstract for my practicum to submit to Sports Neuropsychology Society. Worked on thesis.

Friday, February 25th, 2022

Worked on thesis. Prepared for today's evening participant. Informed consented and collected data for participant.

Monday, February 28th, 2022

Sat in weekly team meeting. Worked on concussion registry audit. Prepared for today's study participant. Worked on thesis.

Tuesday, March 1st, 2022

Worked on Journal Club 3 emails. Continued to work on thesis rough draft. Made participant folders for K5 study.

Wednesday, March 2nd, 2022

Continued to work on thesis rough draft. We had a Sports Therapy & Research employee appreciation lunch. Continued to work on thesis rough draft. Prepared for today's study participant. Informed consented, collected data, and helped clean up study equipment.

Thursday, March 3rd, 2022

Worked from home. Continued to work on thesis rough draft.

Friday, March 4th, 2022

Came in early for study participant. Asked a few questions regarding physical activity and collected data for study visit. Continued to work on thesis rough draft. Had an evening participant. Informed consented, collected data, and helped clean study equipment. Sent thesis rough draft out to on-site mentors/team for edits.

Monday, March 7th, 2022

Sat in weekly team meeting. Worked on abstract for Sports Neuropsychology Society (SNS) call for posters submission. Elaborated on concussion registry audits.

Tuesday, March 8th, 2022

Worked on SNS abstract. Continued to work on elaborating concussion registry audits.

Wednesday, March 9th, 2022

Sent out emails for Journal Club 4 covering muscular rate of force development. Continued to work on SNS abstract and sent it out for on-site mentors to review. Emailed the biostatistician requesting for more statistics reports. Completed elaborating concussion registry audits and sent it off to Taylor. Made folders for upcoming KVAL study participants. Assembled clean KVAL masks, bagged, and labeled them.

Thursday, March 10th, 2022

Worked on my thesis rough draft edits from home.

Friday, March 11th, 2022

Worked on my thesis rough draft edits from home.

Monday, March 14th, 2022

Sat in weekly team meeting. Continued to work on thesis rough draft edits. Sent out rough draft to major professor for edits.

Tuesday, March 15th, 2022

Entered completed participant study data into REDCap. Continued to work on thesis rough draft edits. Worked on scheduling times for my mock presentations to the research team and the on-site mentors in the next two weeks. Started working on fleshing out my presentation.

Wednesday, March 16th, 2022

Continued to work on thesis practicum rough draft, adding chapter 3. Scheduled mock presentations with research team and on-site mentors. Donated blood at building blood drive.

Thursday, March 17th, 2022

Continued to work on thesis practicum rough draft. Worked on thesis presentation. Created new K5 validation study participant folders. Worked on Journal Club.

Friday, March 18th, 2022

Worked from home.

Monday, March 21st, 2022

Worked on finalizing thesis practicum rough draft. Sat in weekly team meeting. Continued to work on thesis practicum.

Tuesday, March 22nd, 2022

Worked from home on thesis practicum report. Met with Evan and Taylor to discuss significance section in thesis. Worked on thesis presentation.

Wednesday, March 23rd, 2022

Practiced thesis presentation. Had a mock-presentation with the research team and on-site mentors. Worked on finalizing edits for thesis practicum report and sent it out to committee members.

Thursday, March 24th, 2022

Worked from home. Worked on thesis presentation edits.

Friday, March 25th, 2022

Had two participants come in for the KVAL study. Received informed consent from one, collected data for both participants. Entered one participant's completed data into REDCap. Worked on thesis presentation edits. Worked on thesis practicum report formatting.

Friday, March 25th, 2022

Had two participants come in for the KVAL study. Received informed consent from one, collected data for both participants. Entered one participant's completed data into REDCap. Worked on thesis presentation edits. Worked on thesis practicum report formatting.

Monday, March 28th, 2022

Prepared for mock thesis presentation with the research team and Dr. Driver. Worked on edits for the presentation.

Tuesday, March 29th, 2022

Worked from home. Continued to work on presentation.

Wednesday, March 30th, 2022

Continued to work on presentation. Met with Taylor to discuss presentation and intern responsibilities. Prepared questions for meeting with Kendall. Met with Kendall to talk about the statistics report for our thesis.

Thursday, March 31st, 2022

Worked from home. Had a mock thesis presentation with my major professor. Worked on presentation edits.

Friday, April 1st, 2022

Worked from home. Worked on thesis presentation edits and presentation practice.

Monday, April 4th, 2022

Sat in weekly team meeting. Practiced thesis presentation. Met with Taylor to talk about intern responsibilities. Practiced thesis presentation. Met with major professor to practice thesis presentation. Prepared for tomorrow's in-person thesis defense.

Tuesday, April 5th, 2022

In-person thesis defense presentation at UNTHSC.

Wednesday, April 6th, 2022

Finished edits for the practicum report. Had a going-away lunch/grouping with the research team and Sports Academy.

Thursday, April 7th, 2022

Worked from home.

Friday, April 8th, 2022

Collected data for two K5 validation study participants. Met with Marshall to discuss the future of Journal Club for the upcoming interns. Met with Evan for exiting actions for the internship. Uploaded Journal Club presentations and notes for future CRM intern.