EVALUATION OF SLEEP AMONG NCAA DII WRESTLERS
OVER A COMPETITION SEASON

By

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Exercise Science to the office of Graduate and Extended Studies of East Stroudsburg University of Pennsylvania

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ABSTRACT

A Thesis Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Science in Exercise Science to the Office of Graduate and
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Title: Evaluation of Sleep among NCAA DII Wrestlers over a competition season

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Abstract

Introduction: There has been significant attention given to sleep deprivation in college students, especially within the student-athlete population. The demands of a competitive season coupled with academic responsibilities often lead to deprioritizing sleep. **Purpose:** The purpose of this study is to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice in order to evaluate how well they are recovering. **Methods**: This observational study used the Athlete Sleep Screening Questionnaire combined with two questions concerning their perceived level of performance and the perceived difficulty of practices throughout the week. These questions were answered weekly via online survey to record the sleeping habits of NCAA Division II college wrestlers (n=14) during the 6-week time period leading up to the Super Region National Qualifying Tournament. **Results**: Descriptive statistics from their sleeping habits were cross-referenced with their perceived performance and difficulty of the practices for that week to determine whether they were getting adequate recovery from sleep as it relates to performance. **Conclusion:** Entering the research, it was hypothesized that according to prior research that college students were not getting adequate rest and it would affect their performance; however, multiple Chi Square analysis in this study did not support that hypothesis. The amount of sleep, time to fall asleep, and whether they had trouble staying asleep appeared to have no statistical significance in the relationship to perceived performance.

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

Figure

LIST OF TABLES

TABLE

CHAPTER I:

INTRODUCTION

There is no secret that sleep plays a pivotal role in the health, wellness, and recovery of people in everyday life. In particular the college-aged population often practices less than ideal sleep patterns (Bolin, 2019). Furthermore, college aged student-athletes generally have an even higher need for sleep caused by increased demands of physical activity and time taken out of their schedules for practice and competition in order to recover and perform at the highest levels, especially at the end of the season (Fullagar et al., 2015; Watson, 2017).

According to the American Academy of Sleep Medicine, for optimal health of the cardiovascular, mental, and immune systems, adults require between 7-9 hours of sleep (Watson, 2015). Two studies found that athletes may require more sleep than sedentary individuals allowing for adequate recovery and adaptation, possibly requiring closer to 9-10 hours of sleep instead of the 7-9 hours recommended for most adults (Fullagar et al., 2015; Watson, 2017). Sleep will vary greatly from person to person and can fluctuate day to day within the same individual, based on a number of factors including psychological and physiological stress levels, illness, or sleep debt (Watson, 2017). Elite athletes

typically get less sleep than non-athletes and it appears not to matter whether they were strength or endurance based, team or individual sports. (Vitale et al., 2019).

Sleep quantity is only one factor of sleep, and sleep quality has been getting more recognition recently as another important factor in sleep health. In a study utilizing the Pittsburgh Sleep Quality Index (PSQI) on 628 athletes across 29 sports at Stanford University, Mah et al., (2018) found that 42.4% of athletes experience poor sleep quality and 39.1% of athletes reported inadequate sleep that regularly obtain less than seven hours of sleep during the week.

Either reduced sleep quality or quantity can lead to fatigue, daytime tiredness, and reduced athletic performance, including strength and endurance, reaction time, accuracy, and cognitive function (Vitale et al., 2019). Other adverse physiological effects to recovery and performance include negative influences on hormone balance and metabolism, reduced muscle glycogen storage, and a weakened immune system (Bolin, 2019). While there has been research done concerning sleep deprivation and reduced sleep quality as they relate to declining performance, it has primarily been done on other sports or at the NCAA Division I level only. Additionally, it is only recently that a sleep screening questionnaire has been developed to evaluate college athletes and this allows more specific data for this special population.

Purpose

The purpose of this study was to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice.

Hypothesis

1) NCAA Division II wrestlers sleep patterns will affect their recovery and impact performance levels during the six weeks leading up to the Super Regional National Qualifier.

2) There would be no significant difference in the relationship of sleep quantity between weeks of the study.

3) There would be no significant difference regarding the relationship of sleep quantity and lower/upper classmen during the final week.

4) There would be no significant difference in the relationship between the time to fall asleep between weeks of the study.

5) There would be no significant difference in the relationship between athletes having trouble staying asleep at night across the weeks of the study.

6) There would be no significant difference in the relationship between the quantity of sleep and the perceived performance across the study.

Limitations

For the purpose of this study the following limitations applied:

1) Not all wrestlers have the same academic schedule or demands outside the wrestling room

2) Self-reported surveys were anonymous, however subject honesty is not guaranteed.

3) Study does not contain information pertaining to immune system and illnesses.

4) Some athletes take over the counter and prescription sleep aide.

Delimitations

For the purpose of this study the following delimitations applied:

1) Male only wrestlers

2) NCAA Division II wrestlers

3) East Stroudsburg University and Kutztown University wrestlers

Operational Definitions

For the purpose of this study the following operational definitions applied:

1) Sleep Patterns– The combination of both sleep quantity and quality, including time to fall asleep, trouble staying asleep, and frequency of naps throughout the week

2) Lower Classmen – Participants that are in their freshman or sophomore year

3) Upper Classmen – Participants that are in their junior or senior year

4) Lower Weight – Participants with certified weights in the lower 5 weight classes (125, 133, 141, 149 & 157)

5) Upper Weight – Participants with certified weights in the upper 5 weight classes (165, 174, 184, 197, 285)

6) Perceived level of performance – Wrestlers' own account of their performance level at practice on a scale from 1-10

7) Perceived level of difficulty – Wrestlers' own account of how difficult practices appeared to them on a scale from 1-10

Summary

There is an apparent need for adequate sleep, especially for college athletes. The data collected from the demographic survey and Athlete Sleep Screening Questionnaire (ASSQ), gave detailed information concerning their sleep patterns, giving the ability to have it compared with both the perceived level of performance and whether they were an upper or lower classmen. This study will look specifically at the collegiate male wrestling population with regards to sleep and how well these college student athletes are recovering as they approach the post-season. The results are an insight into how well NCAA Division II wrestlers are recovering with regards to the effect of their sleep patterns on the recovery process.

CHAPTER II:

LITERATURE REVIEW

The purpose of this study was to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice. This chapter will present the literature review (Sleep Physiology, Sleep Deprivation, Sleep Quality, Sleep Assessment) to guide the research questions.

Sleep Physiology

Human sleep occurs in stages that repeat various cycles throughout the night. The first few stages are sometimes grouped together as non-rapid-eye-movement (nREM) and REM sleep, but there are differences in what occurs within the body during each stage of the cycle. During nREM the body experiences a greater volume of cell division and regeneration, a vital processes for muscle recovery (Fullagar et al., 2015).

The nREM group of stages can be broken down into two phases, light sleep and deep sleep. Light sleep includes the first two stages of sleep. Stage I: Very light sleep, only accounts for roughly 5% of total sleep time and generally only occurs during the first cycle (Bolin, 2019). Stage II: Light sleep, is characterized by intermittent rapid

bursts of coordinated neurologic activity called sleep spindles. During this time, the brain is processing recently acquired information, including new movement patterns or skills, training tips, and advice from coaches (Fullagar et al., 2015).

The second phase in the nREM portion of the cycle is Stage III: Deep sleep, characterized by restorative, dreamless, sleep. During this stage neurological metabolic debris is cleared and long-term memories are formed (Bolin, 2019). Concurrently, during this deep sleep stage is where the body is regulating hormone levels. One of these is cortisol, which is the stress hormone, and when these levels get too high, it tends to have a negative impact on glucose processing, thereby leading to compromised fueling in extended events lasting longer than 90 minutes (Fullagar et al., 2015).

Another very important hormone for athletes which is regulated and secreted during deep sleep is human growth hormone (hGH). Godfrey et al. (2003) note hGH has many varied roles ranging from the turnover of muscle, bone and collagen, to the regulation of specific aspects of metabolic functions like body composition maintenance and increasing fat metabolism. Throughout the day hGH is released from the anterior pituitary in response to a variety of stimuli including exercise, sleep, and stress (Fullagar et al., 2015). These are important in repair and regeneration for academic and athletic development and adaptation. Additionally, Fullagar et al., (2015) note that HGH production during deep sleep promotes tissue repair and recovery of the body and muscles, critical for maintaining sustained performance.

The final stage, REM sleep, also known as dream sleep, further enhances long-term memory formation (Bolin, 2019). REM sleep is especially important for athletes are required to remember detailed information or are required to remember high levels of

complicated and complex movements (Fullagar, 2015). Van Cauter and Plat (1996) found that approximately 70% of the body's HGH secretions coincide with Stage III and REM sleep.
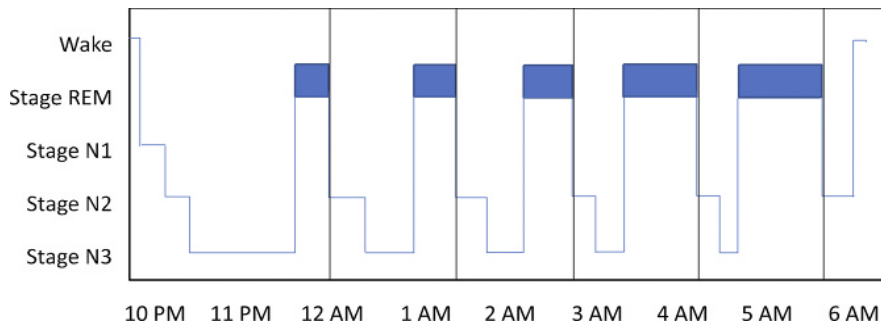
Figure 1: Hypnogram of normal sleep architecture (Bolin, 2019).

The EEG scoring during a polysomnogram data in Figure 1 was obtained from Bolin (2019). It illustrates how Stage II, III and REM sleep cycles change throughout the night during each sleep cycle. Notice that Stage II goes down as the night progresses and Stage III and REM increase. It also displays how these important components of sleep would be drastically reduced when sleep is cut short.

Sleep Quantity and Quality

The time commitments required by college students to study and be involved with other activities on campus often leaves them at a loss for time in their schedule. Quite often the first thing left out of the schedule is sleep, leading to sleep deprivation or reduced sleep quantity. Sleep deprivation in college aged students promotes them to be more likely to use over-the-counter stimulant medications to stay awake and use alcohol or sleep aids to encourage sleep (Bolin, 2019).

This can be just the beginning as there are a multitude of physiological effects relating to sleep deprivation. According to Bolin (2019) sleep deprivation leads to negative influences on hormone balance and metabolism, reduced muscle glycogen storage, and a weakened immune system. Sleep deprivation is also associated with an array of psychological factors. These can range from depression and negative moods to the detrimental impact it has on learning, memory, and judgment. Radek, Hernandez and Pauley (2013) agree, finding there is a both a negative impact on athletic performance and the intensity of exercise from lack of sleep.

The demands of being a student-athlete increases this sleep deprivation for many college athletes with the added practice and competition demands to their school classes, studying, work to be done outside of class as well as their engagement in other campus related activities.

In addition to sleep quantity, there are also potential adverse effects to reduced sleep quality in college level athletes. Reduced sleep quality can lead to a wide array of consequences for athletes. Bolin (2019) notes that sleep quality can be a subjective or objective measure and relates to more than just how well they slept and should be looked at more closely by the metabolic and physiologic roles that occur during each sleep.

A study by Radek et al. (2013) shows that sleep quality in athletes can vary significantly from in season and out of season. Their study showed that athletes who were lacking sleep at night needed more recovery time. This shows that sleep quality in athletes can vary significantly from in season and out of season due to the intensity and timing of workouts. They also note that improved sleep efficiencies during non-season play could be related to the reduced the athletes' practice and competition schedule

allowing for more sleep opportunities. Additionally, their study noted that time commitment and intensity of workouts potentially competes with and affects their sleep quality, again requiring more recovery time (Radek et al., 2013). This is characteristic of the college athlete population during the season and warrants investigation.

Napping

A frequent element of sleep that can be caused by either reduced sleep quality or quantity among college students is napping. Ye et al. (2015) indicated that napping in college populations may be a common method for students to cope with insufficient sleep and feeling fatigued during the day. Their research on 440 undergraduate students found 75% of the participants had napped in the past month and 42.9% napped at least once per week. Other research shows that there is benefits to napping, but there are a few things that should be considered including the timing and duration, what time they woke previously, environment, and individual characteristics. Additionally, the best time receive benefits from napping were immediately following lunch and that naps longer than 30 minutes can cause confusion, grogginess and reduced cognitive performance (Bird, 2013).

Sleep Assessment

In 2016, research was conducted to develop a subjective, self-report, sleep-screening questionnaire for elite athletes. This was because they found that the current sleep screening methods were inapt in assessing sleep in athletes (Samuels et al., 2016). This research led to the creation of the Athlete Sleep Screening Questionnaire (ASSQ), a 16-item questionnaire which was developed using tools and items from other sleep assessment protocols and tests. The ASSQ can be completed online and provides clinical

cut-off scores associated with specific clinical interventions to guide management of

athletes' sleep disturbance. These scores provide an accurate method of which athletes

would benefit from preventative measures and which athletes suffer from clinically

significant sleep problems and potentially need to see a specialist (Samuels et al., 2016).

For the purpose of this study, clinical recommendations are not the objective, but a series

of questions pertaining to the athletes detailed sleep patterns (quantity and quality)

leading to the appropriate variables to reference within the athletic population.

CHAPTER III:

METHODOLOGY

The purpose of this study was to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice. This chapter will present the methodology (Subjects, Instrumentation Procedures, Data Analysis) of the research.

Subjects

The subject population for this study was comprised of NCAA Division II wrestlers from two Eastern Pennsylvania State Universities, including Kutztown and East Stroudsburg Universities. In order to be included in this study, participants were required to be at least 18 years of age and be enrolled with full-time class schedules (minimum 12-credits) at the university for which they competed throughout the duration of the study. Ethical approval was granted from the Institutional Review Board (IRB) for each university before data collection period started which can be found in Appendix A.

The study was originally designed to observe the participants nutritional intake in the form of a 3-day food log on My Fitness Pal in addition to the ASSQ and

performance/difficulty surveys. There was a relatively high dropout rate due to 11 participants out of the 25 who started the data collection openly indicated dropping out because they felt it was too much to do and they were a little overwhelmed. Although daunting to the participants, this food log component to recovery would provide a whole new dimension of understanding to the recovery and performance of college athletes. When the study reached 14 the decision was made to delete the food log from the research in order to retain a sufficient number of participants.

Instrumentation

The Athlete Sleep Screening Questionnaire (ASSQ) is a 16-item questionnaire which was developed by Samuels et al. (2016), using tools and items from other sleep assessment protocols and tests. This was due to the fact that standard sleep screening assessments seemed to produce incorrect results within the elite athlete population. The ASSQ can easily be completed online and provides clinical cut-off scores associated with specific clinical interventions to guide management of athletes' sleep disturbance. A study completed by Bender et al. (2018) to clinically validate the ASSQ yielded a diagnostic sensitivity of 81%, specificity of 93%, positive predictive value of 87%, and negative predictive value of 90% in population of 199 Canadian National team athletes. This provides validity that this method of accurately determining which athletes would benefit from preventative measures and which athletes suffer from clinically significant sleep problems. The questions are attached in Appendix D.

Procedures

The following procedures were implemented during this study:

1) First an in-person meeting with each team was scheduled. During this informational meeting, an explanation of the study was given and interested participants signed informed consent form located in Appendix B

2) Research identification numbers were assigned to participating subjects in the order they handed back their informed consent, which were used to be link participants to their information without identifying characteristics.

3) Participants filled out "Participant General Demographic Information" questionnaire located in Appendix C.

4) Explanation of procedures for data collection and how the questions are to be answered, as well as a familiarization period with Google Forms.

5) During the six weeks leading up to the Super Regional National Qualifying tournament, the questionnaire was filled out weekly on Mondays throughout the observation period.

6) After the collection period, data was exported to an Excel Spreadsheet and sorted accordingly before statistical analysis using IBM SPSS Statistics 25.

Data Analysis

Subject demographics were analyzed with descriptive statistics. All null hypothesis was analyzed with chi-square with an apriori alpha of 0.05. SPSS 25.0 was used for all analysis.

CHAPTER IV:

RESULTS

The purpose of this study was to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice. This chapter presents the results for the demographics of the subjects and statistical analysis of null hypothesis.

Table 1. *Subject Demographic Data*

ID #	Age	Year	Certified Weight	Live on Campus?
2	25	SR	184	N
3	20	JR	133	N
4	18	FR	133	N
5	23	SR	174	N
6	18	FR	133	Y
7	18	FR	174	Y
11	19	FR	157	N
12	20	JR	149	N
13	18	FR	125	Y
14	22	SR	149	N
15	19	FR	157	Y
18	19	SO	157	Y
19	22	JR	141	N
20	21	SR	197	N

This study started with 25 student-athletes from two eastern Pennsylvania NCAA Division II universities. The research period ended with a total of 14 participants who completed

all 6-weeks of data collection. These students expressed an age range of 18-25, and a mean age of 20.14 (SD±2.18). The contributors were split evenly with 7 upperclassmen (4 seniors, 3 juniors), and 7 underclassmen (1 sophomore, 6 freshmen). Only five of the participants reported living on campus, and all of them were underclassmen.

Table 2. *Relationship of sleep quantity across the study*

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Total
	O	E	O	E	O	E	O	E	0	E	0	E	
5 to 7	6	7.17	8	7.17	8	7.17	6	7.17	6	7.17	9	7.17	43
>7	8	6.83	6	6.83	6	6.83	8	6.83	8	6.83	5	6.83	41
	14		14		14		14		14		14		84

When interpreting the Chi-Square tables, the "O" represents the Observed value for the survey, whereas the "E" is representative of the Expected value of the formula. The Chi-Square calculated value was 2.52, which is lower than the book value of 11.07 (5 df at the 0.05 alpha level). Therefore, we fail to reject the hypothesis, there was no significant difference between the weeks of the study and the amount of sleep the athletes reported. There was however, a slightly larger gap in the final week, but the other Chi-Square values for the first five weeks prior may have masked this trend.

Table 3. *Relationship of sleep quantity and class in final week*

	Upper		Lower		Total
	O	E	O	E	
<7	5	4.5	4	4.5	9
>7	2	2.5	3	2.5	5
	7		7		14

The Chi-Square calculated value was 0.31, which is lower than the book value of 3.84 (1 df at the 0.05 alpha level). We fail to reject the null hypothesis, there is no significant difference in the quantity of sleep between upper and lower classmen in the final week. Almost two-thirds of the participants reported sleeping less than 7 hours.

Table 4. *Relationship of sleep quantity and certified weight in final week*

	Lower Weight		Upper Weight		Total
	O	E	O	E	
<7	6	6.42857	3	2.57143	9
>7	4	3.57143	1	1.42857	5
	10		4		14

The Chi-Square calculated value was 0.28, which is lower than the book value of 3.84 (1 df at the 0.05 alpha level). We fail to reject the null hypothesis, there is no significant difference in the quantity of sleep between upper and lower certified weight classes in the final week. There were 60% of lower weights compared to 75% of upper weights who reported sleeping less than 7 hours.

Table 5. *Relationship of time to fall asleep across the study*

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Total
	O	E	O	E	O	E	O	E	0	E	0	E	
<16	2	3.5	5	3.5	3	3.5	3	3.5	4	3.5	4	3.5	21
16-30	6	6.33	7	6.33	7	6.33	6	6.33	5	6.33	7	6.33	38
>30	6	4.17	2	4.17	4	4.67	5	4.17	5	4.17	3	4.17	25
	14		14		14		14		14		14		84

The Chi-Square calculated value was 4.05, which is lower than the book value of 18.31 (10 df at the 0.05 alpha level). This shows there was no significant difference across the six weeks of the study when observing the length of time it took each athlete to fall asleep each night, and the null hypothesis is not rejected. It is important to note at this point that almost 29% of students reported using a prescribed or over-the-counter sleep aide each week.

Table 6. *Relationship of time to fall asleep and certified weight in final week*

	Lower Weight		Upper Weight		Total
	O	E	O	E	
<16	2	2.86	2	1.14	4
16-30	6	5	1	2	7
>30	2	2.14	1	0.86	3
	10		4		14

The Chi-Square calculated value was 1.73, which is lower than the book value of 5.99 (2 df at the 0.05 alpha level). We fail to reject the null hypothesis, there is no significant difference in the time to fall asleep and the athlete's certified weight class. There were 60% of the lower weights that reported 16-30 minutes and half of the upper weights fell asleep in under 16 minutes.

Table 7. *Relationship of trouble staying asleep across the study*

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Total
	O	E	O	E	O	E	O	E	0	E	0	E	
0	4	3.5	3	3.5	2	3.5	2	3.5	4	3.5	6	3.5	21
1 or 2	7	7.17	7	7.17	8	7.17	8	7.17	7	7.17	6	7.17	43
3+	3	3.33	4	3.33	4	3.33	4	3.33	3	3.33	2	3.33	20
	14		14		14		14		14		14		84

The Chi-Square calculated value was 4.61, which is lower than the book value of 18.31 (10 df at the 0.05 alpha level). This fails to reject the hypothesis that there were any significant differences in the occurrences per week that the participants had trouble staying asleep.
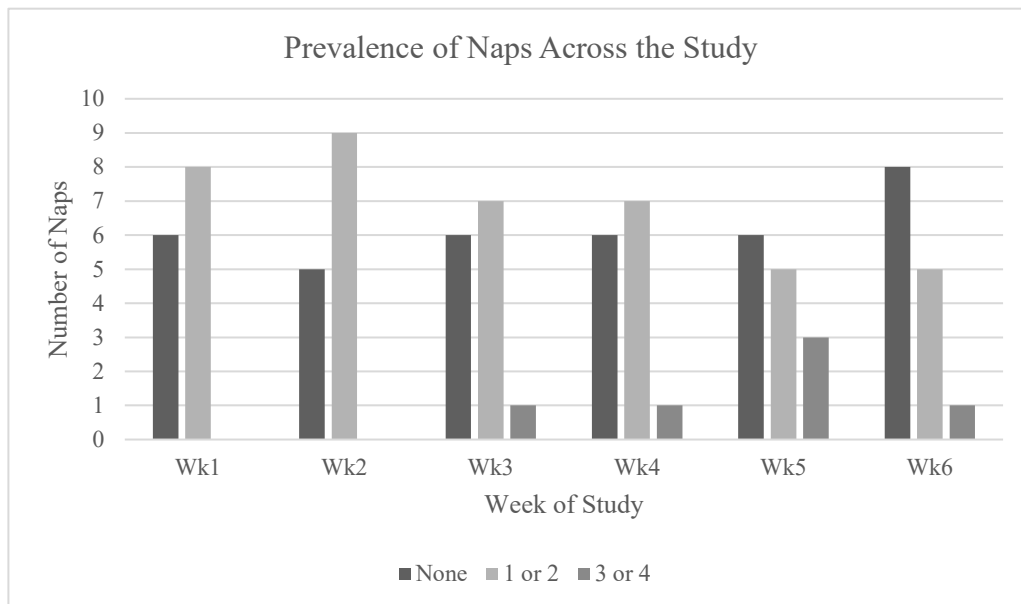

Figure 2. *Histogram showing prevalence of naps across the study*

Figure 2 is a histogram depicting the prevalence of naps across the weeks of the study. Roughly 6 participants per week did not nap during the week, with almost 7 participants napping once or twice. Notably in week 5, there were three participants who reported napping 3-4 times per week.

Week	Average Perceived Performance	Week	Average Perceived Difficulty
20-Jan	6.2	20-Jan	5.6
27-Jan	6.6	27-Jan	5.5
3-Feb	7.2	3-Feb	6.3
10-Feb	6.9	10-Feb	6.3
17-Feb	7.2	17-Feb	6.2
24-Feb	6.8	24-Feb	5.4
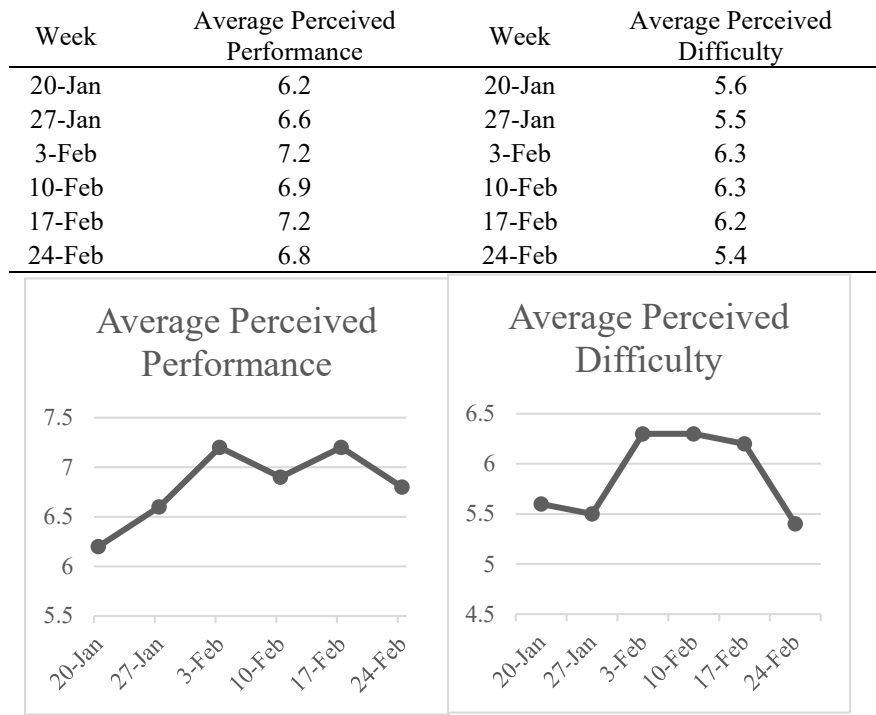
Figure 3. *Average perceived performance and difficulty across the study*

These graphs in Figure 3 represent the perceived level of performance and the perceived level of difficulty in each week during practice. Although not evaluated statistically, the pattern for practice difficulty and practice performance showed modest similar trends.

Table 8. *Relationship of average sleep quantity and perceived performance across the study*

	Week 1		Week 2		Week 3		Week 4		Week 5		Week 6		Total
	O	E	O	E	O	E	O	E	O	E	O	E	
5 to 7	6.57	6.15	6.25	6.89	7	7.17	6.83	6.77	7.5	7.17	7.44	7.44	41.59
>7	5.86	6.28	7.67	7.03	7.5	7.33	6.86	6.92	7	7.6	7.6	7.6	42.49
	12.43		13.92		14.5		13.69		14.5		15.04		84.08

The Chi Square calculated value is 0.24, which is lower than the book value of 11.07 (5 df at the 0.05 alpha level). We fail to reject the hypothesis, there was no statistical difference between the amount of sleep the athletes reported and their perceived level of performance.

CHAPTER 5:

DISCUSSION/CONCLUSION/FUTURE RECOMMENDATIONS

The purpose of this study was to observe NCAA Division II male college wrestlers leading up to their national qualifying tournament to see what, if any relationship there is between their sleep patterns and their perceived level of performance during practice. This chapter presents the discussion, future recommendations, conclusion).

Discussion

Results suggest that the collegiate athlete subjects were not getting the recommended sleep quantity across the six weeks of the study. As shown in Table 2, over half of the individual data records for sleep quantity indicated 5-7 hours nightly. More importantly, during the final week of the study, when recovery from sleep is likely to be more important, only 5 of the 14 reported sleeping more than 7 hours. Tables 3 & 4 detail the final week of sleep quantity in two different sub-populations within the study. Table 3 represents the division by class where Table 4 represents the certified weight classes. There were 9 participants 5 of which were upperclassmen athletes reporting 7 hours or less, and 60% of lower weights compared to 75% of upper weights who reported sleeping

less than 7 hours. This indicates the majority of the participants are recording much lower than the recommended 7-9 hours of sleep for adults and far less than the 9-10 hours of sleep quantity per night for college level athletes. As a potential result, these athletes are likely missing the vital extended Stage III and REM sleep cycles, leading to reduced HGH secretion followed by adverse effects in recovery and performance as well as memory storage and other vital processes that occur in these later stages of the sleep cycle are impacted.

The overall sleep quality of the participants appears to be of concern as well. This includes the elements surveyed concerning the length of time it took to fall asleep, whether they had trouble staying asleep, and how many naps they took. Table 5 shows there is no significant changes across the weeks of the study in relation to the amount of time it took the participants to fall asleep, but does indicate that 75% of the time, it took 16 minutes or longer with approximately 30% of the total responses being 31 minutes or longer, meaning they are experiencing sleep onset latency, one of the symptoms of poor sleep quality. Table 6 looked at the final week of the study regarding the time to fall asleep in reference to the certified weight class and found that 60% of the lower weights were falling asleep in the 16-30 minute range whereas the upper weights recorded half falling asleep in under 16 minutes. These results were consistent with prior research and show difficulty in the sample population falling asleep quickly. Furthermore, the fact that about 29% of the participants reported taking some type of sleep aide shows there may be some underlying issues affecting their sleep quality and could mean these values for time to fall asleep could be even worse than the numbers indicate.

Another major component of sleep quality is the ability to stay asleep at night and although there were no significant differences across the weeks of the study (Table 7), 3/4 of the participant population had difficulty staying asleep, waking at least 1 or 2 times per night. The fact that only 25% of the total responses indicated the participants slept through the night for the whole week draws concern for these athletes. Not only does it point to inadequate sleep at night, it may be related to the sleep onset latency reported in Tables 5 & 6, as well as interfering with the Stage III and REM sleep cycling being interrupted. The reason for waking was not included in the questionnaire and could be caused by non-physiological factors or disturbances.

The histogram in Figure 2 shows the prevalence of naps reported each week. The first two weeks were the last week of winter camp and the first week the participants returned to classes. There were no more than 2 naps taken by any of the participants and a relatively low perceived performance. During the fifth week, there was a spike in the 3-4 per week and then during the final week a high volume of participants not napping at all. This final week also corresponded with the same time period where there was a drop in the quantity of overall sleep and perceived performance. Therefore, it is difficult to determine whether the reduced perceived performance in the last week was due to the reduced sleep quantity, where a lack of sleep and minimal naps occurred, or the sleep quality, but there is an apparent need for more recovery from sleep.

Given that the perceived performance and perceived difficulty of practices throughout the study showed modest similar trends, weeks 4 and 6 show elevated concerns for their recovery and performance. As the difficulty of practices went down their performance should theoretically have gotten better. Instead, Figure 3 shows during

week 4 and 6 the average difficulty (6.3, 5.4) with performance values (6.9, 6.8) being recorded. The final week of performance is one of the most important for rest and recovery, which the participants were not experiencing. This is yet another indicator these college athletes are not recovering properly as it relates to sleep.

One major perspective that should be noted which is not covered by the line of questioning in the survey is the high psychosocial demands which these athletes are experiencing during the time of this study. These are especially present in the last 2-3 weeks (weeks 4-6) in which the study takes place. Weeks 4-6 of the study line up with week 3-5 of the academic semester and this is a common time for many professors to be scheduling their first round of major exams, due dates for projects and other assignments, which can place an added burden on the student-athlete. Also, the last week leading up to the end of the study is possibly the most important week of the season for many athletes as they are going through their period of wrestle-offs for one of the 10 spots that go to the national qualifying tournament. Earning one of these 10 spots is what they work for the entire year and often times a scholarship goes with getting one of these spots. Both of these psychosocial demands may have had an influence on the sleep patterns of the athletes in this study.

There are a multitude of other different factors which could be affecting their sleep, but a good place to start in addressing these sleep pattern issues would be in educating these athletes on the negative effects of sleep deprivation (quantity or quality) and the importance it has on recovery. Encouraging some sleep hygiene strategies would be a good place to start. Table 7 contains a list of 10 researched sleep

hygiene recommendations for athletes.

Table 7. *Healthy Sleep Hygiene Recommendations (Vitale et al., 2019)*

1. Don't go to bed until you are sleepy. If you aren't sleepy, get out of bed and do something else until you become sleepy.
2. Regular bedtime routines/rituals help you relax and prepare your body for bed (reading, warm bath, etc.).
3. Try to get up at the same time every morning (including weekends and holidays).
4. Try to get a full night's sleep every night and avoid naps during day if possible (if you must nap, limit to 1 h and avoid nap after 3 p.m.).
5. Use the bed for sleep and intimacy only; not for any other activities such as TV, computer, or phone use, etc.
6. Avoid caffeine if possible (if must use caffeine, avoid after lunch).
7. Avoid alcohol if possible (if must use alcohol, avoid right before bed).
8. Do not smoke cigarettes or use nicotine, ever.
9. Consider avoiding high-intensity exercise right before bed (extremely intense exercise may raise cortisol, which impairs sleep).
10. Make sure bedroom is quiet, as dark as possible, and a little on the cool side rather than warm (similar to a cave).

In addition to educating college athletes on sleep hygiene, educating them on how to track their sleep and what their body is doing while they are asleep may encourage them to be more consciously aware of their sleep patterns and hopefully make it more of a priority.

Future Recommendations

There were six weeks of data collected during this study which only represents the second half of the season and only 14 participants.

The ASSQ is more designed to diagnose sleep disorders and those who would benefit from professional consultation and potential treatment of sleep disorders. Much of the literature indicated the Athlete Sleep Behavior Questionnaire (ASBQ) could be a more reliable assessment that can differentiate the sleep practices between athletes and non-athletes, and offers a practical instrument for practitioners and/or researchers wanting to evaluate the sleep behaviors of college athletes.

Conclusion

Despite the limitations of the study, this research demonstrates that NCAA Division II college wrestlers are not recovering as well from sleep as they could be at the end of the season, when it matters the most. This may lead to a reduced performance as it relates to recovery from sleep patterns. This study does not show all the factors related to recovery and adaptations but provides a starting point for coaches to direct their athletes through the use of sleep education and sleep hygiene.

Appendix A1. East Stroudsburg University IRB Approval Form

East Stroudsburg University Institutional Review Board
Human Research Review
Protocol # **ESU-IRB-028-1920**

Date: **January 10, 2020**

To: **Kristopher Gelsinger and Shawn Munford**

From: **Shala E. Davis, Ph.D., IRB Chair**

Proposal Title: **"How well are NCAA Division II Wrestlers Recovering"**

Review Requested: Exempted   Expedited **X**   Full Review

Review Approved: Exempted   Expedited **X**   Full Review

FULL RESEARCH

_____   Your full review research proposal has been approved by the University IRB (12 months). Please provide the University IRB a copy of your Final Report at the completion of your research.

_____   Your full review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

_____   Your full review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit.

EXEMPTED RESEARCH

_____   Your exempted review research proposal has been approved by the University IRB (12 months). Please provide the University IRB a copy of your Final Report at the completion of your research.

_____   Your exempted review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

_____   Your exempted review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit, if appropriate.

EXPEDITED RESEARCH

_X_   Your expedited review research proposal has been approved by the University IRB (12months). Please provide the University IRB a copy of your Final Report at the completion of your research.

_____   Your expedited review research proposal has been approved with recommendations by the University IRB. Please review recommendations provided by the reviewers and **submit necessary documentation for full approval.**

_____   Your expedited review research proposal has not been approved by the University IRB. Please review recommendations provided by the reviewers and resubmit, if appropriate.

Please revise or submit the following:

Appendix A2. Kutztown University IRB Approval Form

KUTZTOWN
U N I V E R S I T Y

January 17, 2020

Mr. Gelsinger:

Your request to conduct the research project titled *" How Well Are Division II College Wrestlers Recovering?"* on our campus has been reviewed. Kutztown University accepts the approval granted by the East Stroudsburg University's IRB. The research is approved for the period expressed in the approval from the East Stroudsburg University IRB.

Please note that Kutztown University expects you to comply with all IRB policies and procedures; applicable federal, state and local laws; and the ethical principles of your profession. You must notify the Kutztown University IRB promptly if you wish to make any revisions or changes to your study, and if there are any adverse events or unanticipated problems. Should you need to continue your data collection beyond the approval period stated above, you must submit a written request.

If you have any questions, please contact me via email (werner@kutztown.edu) or phone (484-646- 4167).

Sincerely,

Jeffrey Werner

Assistant Provost for Research & Grants

Appendix B. Informed Consent

ESU EAST STROUDSBURG UNIVERSITY

INFORMED CONSENT
For a Research Study entitled

"Evaluation of Sleep among NCAA DII Wrestlers over a competition season."

You are invited to participate in a research study to assess how well NCAA Division II college wrestlers are recovering through the use of a self-reported sleep questionnaire and a 3-day randomized food log for the period of 6 weeks leading up to the Super Region 1 national qualifying tournament on February 29, 2020. The study is being conducted by Kristopher Gelsinger, Graduate Student, under the direction of Dr. Shawn Munford in the East Stroudsburg University Department of Exercise Science. You were selected as a possible participant because you are an NCAA Division II college wrestler and you are 18 or older.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to complete a sleep study questionnaire every Monday and fill out a randomized 3-day food log on the My Fitness Pal app for a period of 6 weeks. Your total time commitment will be approximately 10-15 minutes per week.

The risks associated with participating in this study are minimal.

There are no direct benefits to participating in this study.

There will be no compensation for participating in this study.

There are no costs associated with participating in this study.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable.

Your privacy will be protected.   Any information obtained in connection with this study will remain *confidential.* (e.g. *used to fulfill an educational requirement, published in a professional journal, presented at a professional meeting, etc…*)

If you have questions about this study, please ask them now or contact Kristopher Gelsinger at kgelsinger@live.esu.edu or Dr. Shawn Munford at smunford@po-box.esu.edu . A copy of this document will be given to you to keep.

If you have questions about your rights as a research participant, you may contact the East Stroudsburg University Institutional Review Board by phone (570)-422-3336 or e-mail at sdavis@po-box.esu.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHERE OR NOT YOU WISH TO PARTICIPATE IN THIS RESARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

_____   _____

Participant Signature   Date   Investigator obtaining consent   Date

_____   _____

Printed Name   Printed Name

Appendix C. Demographic Survey

ESU EAST STROUDSBURG UNIVERSITY

Thesis Study:

HOW WELL ARE DIVISION II COLLEGE WRESTLERS RECOVERING?

Participant General Demographic Information

Participant number: _____ (Issued immediately after signing informed consent)

What is your school email address? _____

Participant name: _____

Age: _____

Year in School

      Freshman   Sophomore   Junior   Senior

Have you redshirted?   Y / N

What is your minimum certified weight class? _____

Do you live on campus?   Y / N

Appendix D. Weekly Online Survey

<u>Athlete Sleep Screening Questionnaire (ASSQ)</u>

INSTRUCTIONS

The following questions relate to your sleep habits. Please choose the best answer which you think represents your typical sleep habits over the past week. For the first 16 questions, select a letter from 'a' to 'e' unless otherwise specified. On The last 2 questions, circle the number above the perceived level in the question.

1. During the recent past, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

     a. 5 to 6 hours

     b. 6 to 7 hours

     c. 7 to 8 hours

     d. 8 to 9 hours

     e. more than 9 hours

2. How many naps per week do you take?

     a. none

     b. once or twice

     c. three or four times

     d. five to seven times

3. How satisfied/dissatisfied are you with the quality of your sleep?

     a. very satisfied

     b. somewhat satisfied

     c. neither satisfied nor dissatisfied

     d. somewhat dissatisfied

     e. very dissatisfied

4. During the recent past, how long has it usually taken for you to fall asleep each night?

     a. 15 minutes or less

     b. 16 – 30 minutes

     c. 31 – 60 minutes

     d. longer than 60 minutes

5. How often do you have trouble staying asleep?

    a. none

    b. once or twice per week

    c. three or four times per week

    d. five to seven days per week

6. During the recent past, how often have you taken medicine to help you sleep (prescribed or over the counter)?

    a. none

    b. once or twice per week

    c. three or four times per week

    d. five to seven times per week

7. Considering only your own "feeling best" rhythm, at what time would you get up if you were entirely free to plan your day?

    a. 5:00 am – 6:30 am

    b. 6:30 am – 7:45 am

    c. 7:45 am – 9:45 am

    d. 9:45 am – 11:00 am

    e. 11:00 am – 12:00 pm (noon)

8. How alert do you feel during the first half-hour after having awakened?

    a. not at all alert

    b. slightly alert

    c. fairly alert

    d. very alert

9. Do you consider yourself to be a morning type person or an evening type person?

    a. definitely a morning type

    b. more a morning type than an evening type

    c. more an evening type than a morning type

    d. definitely an evening type

10. Considering your own "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?

     a. 8:00 pm – 9:00 pm

     b. 9:00 pm – 10:15 pm

     c. 10:15 pm – 12:30 am

     d. 12:30 am – 1:45 am

     e. 1:45 am – 3:00 am

11. When you are travelling for your sport, do you experience sleep disturbance?

     a. Yes

     b. No

12. When you are travelling for your sport, do you experience daytime dysfunction (feeling generally unwell or having poor performance)?

     a. Yes

     b. No

13. Are you typically a loud snorer?

     a. Yes

     b. No

14. Have you been told that you choke, gasp, or stop breathing for periods of time during sleep?

     a. Yes

     b. No

15. On average, how many caffeinated products (caffeine pills, coffee, tea, soda, energy drinks) do you have per day? For coffee and tea, one drink = 6-8oz/177237ml; for caffeinated soda, one drink = 1 can (12oz/355ml)?

     a. Less than 1 per day

     b. 1-2 per day

     c. 3 per day

     d. 4 per day

     e. 5 or more per day

16. Over the recent past, how often do you use an electronic device (example: cell phone, computer,

tablet, T.V. etc.) within 1 hour of going to bed?

      a. Not at all

      b. 1-3 times per week

      c. 4-6 times per week

      d. Every day

17.   What is your perceived level of performance at practice today?

1	2	3	4	5	6	7	8	9	10
Poor				Average					Great

18.   What is your perceived difficulty level of practice today?

1	2	3	4	5	6	7	8	9	10
Easy				Average					Hard

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