The Sleep Habits of NCAA Division II Athletes and Non-Athletes

A THESIS
Submitted to the Faculty of the School of Graduate Studies and Research of California University of Pennsylvania in partial fulfillment of the requirements for the degree of Master of Science

BY
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California, Pennsylvania
2007
CALIFORNIA UNIVERSITY of PENNSYLVANIA  
CALIFORNIA, PA  

THEESIS APPROVAL  

Graduate Athletic Training Education  

We hereby approve the Thesis of  

James J. Pratt  
Candidate for the degree of Master of Science  

<table>
<thead>
<tr>
<th>Date</th>
<th>Faculty</th>
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<tr>
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<td>Dr. Carol Biddington (Research Adviser)</td>
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<td>4/26/07</td>
<td>Dr. Amanda Allen  (Committee member)</td>
</tr>
<tr>
<td>4/26/07</td>
<td>Dr. Coni Cramer Roh (Committee member)</td>
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</table>
Acknowledgements

First and foremost I would like to start by thanking my family. Without their love, strength and support I don’t think I would have been able to survive this past year. No matter where I am or what I am doing they are always willing to lend a helping hand or a comforting word.

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INTRODUCTION

Sleep is an important physical process that is required for adequate functioning in the everyday life of human beings. It is a psychological and physiological process that is necessary for the human body to recover from activities of daily living. There is a perception that seven to eight hours of sleep is the necessary amount needed to recover from a 16-hour waking day. This has been found to be the major cause as to why over 100 million Americans are sleep deprived. In reality, research has found that people need 10 hours of sleep to recover from the stress and strain of a full waking day.

Our sleep process is controlled by a homeostatic sleep drive and our natural circadian rhythm. The homeostatic sleep drive is a process that strives to get enough sleep to function during the day. Our natural circadian rhythm is our internal clock that maintains specific levels of alertness throughout the day. Through these two processes, sleep can easily be understood. The human body is aware of how much time is needed to recover from a full day of activity and will do all it can to ensure that the recovery demand is met. This is why people tend to get tired at the
same time every night and wake up at the same time in the morning.

Sleep deprivation is a very serious problem of which our modern society does not know how to handle. Much research has been conducted to learn about sleep processes, habits, and psychological and physiological needs. Over 100 million people are sleep deprived and 40 million of them suffer from chronic-sleep disorders. People do not understand how easily they can become sleep deprived, especially in today’s society. We live in a society that requires long hours of wakefulness and irregular sleep-wake schedules due to work, family and social pressures and obligations. The less sleep one continues to get, the greater ones sleep debts become. It is important that people reorganize their priorities to include sleep as most important. Sleep deprivation can cause some serious problems in humans such as decreased mental acuity, negatively affecting growth and ability to learn.

For over a decade, research has examined the effects of sleep on performance. Sleep deprivation has been linked to serious learning deficits in the school systems, finding it is harder for students to learn and retain the information when they are up late and awake early in the morning. Not only is education affected by sleep
deprivation, but also a person’s health-status is endangered. Additionally, research has found that risk-taking behaviors increase with sleep deprivation and age.\textsuperscript{4} Sleep deprivation studies have also been conducted to determine its affects on the performance of health care providers. Between 44,000 to 98,000 deaths a year are caused by medical errors. It is likely that sleep deprivation is a contributor to these errors because sleep deprivation affects performance and decision-making processes as a result of fatigue.\textsuperscript{5}

However, limited research has evaluated the effects of sleep deprivation on athletic performance. Sports are an extremely important part of our modern society, whether it is the high school, college, professional, or recreational level. Some research has indicated several implications of sleep deprivation on athletic performance.\textsuperscript{6,7} Exercise has been found to be most beneficial during certain times throughout the day, working in unison with our circadian rhythms. By developing a sleep debt, we put ourselves in a position where our circadian rhythm will be disrupted. This can cause an inability to exercise at our regular desired peak performance time.\textsuperscript{6} As a result of disrupting the circadian rhythm, the time of day that is normally peak performance time will also be disturbed. The implication is
that athletes will not be able to perform at their optimal level as a result of lack of sleep, however there is not conclusive evidence to prove this.

Much of the current research in circulation has determined the physical affects that sleep deprivation has on the human body. For example, impaired motor function, delayed visual and auditory reaction time, reduced cardiovascular performance, and diminished mental functioning are just a few. Athletic performance requires all of these physical functions to compete at an optimal level, therefore it is imperative that more research is conducted to establish the link between sleep deprivation and athletic performance.

Air travel has been found to influence athletic performance because it can offset the circadian rhythm. Air travel is a large part of professional sports because often times, teams travel across multiple times zones for competition. The change in time zones offsets the circadian rhythm by disrupting the sleep-wake cycle creating a sleep deficit. A sleep deprivation caused by travel can also affect the athletes’ ability to weight-lift. Significant deficits have been found in maximal bench press, leg press and dead lifts as a result of sleep deprivation. Weight-lifting is a critical part of athletics, without it
athletes may not be able to compete at the highest level possible. Without this ability athletes can not reach their full performance potential.

In this study, the following questions will be addressed: 1) What are the differences between gender for sleep deprivation? 2) What are the differences between athletes versus non-athletes for sleep deprivation?
METHODS

This section includes the following subsections:
Research Design, Subjects, Instruments, Procedures,
Hypotheses, and Data Analysis.

Research Design

A descriptive design was used for this study. The
dependent variables were the Daytime Sleepiness Scale (DST,
See Appendix C2) score and the Sleep-Wake Behavior Problems
Scale (SWBT, See Appendix C2) score. The DST consists of
questions asking the participants if they struggled to stay
awake in 10 different situations. The SWBT is made up of 15
items, 10 that are indicators of frequency of erratic
sleep-wake behavior over the last 2 weeks. The independent
variables were gender (male or female) and athlete versus
non-athlete. The dependent variables were the scores
received on the two sleep scales. The strength of this
study came from the number of subjects used, the number of
different sports used for the study, and the reliability of
the instruments. A limitation of this study was using only
NCAA Division II athletes from one institution.
Subjects

The subjects (N=391) in this study were selected via a convenience sample of athletes and non-athletes from an NCAA Division II University. Approximately (n=207) male athletes and (n=184) female athletes were surveyed from various sports such as basketball, soccer, golf, softball, cross country, track & field, swimming, tennis, volleyball, football and baseball (n=8 for male sports, n=9 for female sports) at California University of Pennsylvania. The non-athlete subjects were college students in health education classes (n=144). These classes contained students of mixed backgrounds and majors, providing the best method of sampling for this study. The subjects were surveyed about their age, gender, class rank, and sleeping habits. An Informed Consent Form (Appendix C1) was distributed prior to completion of the survey.

Instruments

The instrument used for this research was an abbreviated version of the School Sleep Habits Survey (SSHS) (Appendix C2). The SSHS is a 19-item survey that assesses an individuals sleep habits in two parts, the DST
and SWBT. The DST has a moderate internal reliability, with a coefficient alpha of .70. The SWBT also has a moderate internal reliability, with a coefficient alpha of .75.

Part of the SSHS consisted of a demographic section, some of the questions were regarding age, gender, class rank, racial/ethnic background, and current health status.

The SSHS survey consists of 19 items and is divided into three sections. The first section includes the demographic/background information. Second, is the DST that presents 10 questions pertaining to whether the athlete struggled to stay awake. The questions were answered by filling in blank circles corresponding to four different responses; no (1), struggled to stay awake (2), fallen asleep (3), and both struggled to stay awake and fallen asleep (4). The total possible scores for this scale ranged from 10 to 40, with higher scoring indicating higher levels of daytime sleepiness. The third and final section is the SWBT that consists of 15 items regarding frequency of erratic sleep. The subject rated the frequency by filling in blank circles corresponding to five different responses; everyday/night (1), several times (2), twice (3), once (4), and never (5). Total possible scores for the SWBT ranged from 10 to 50 with higher scores indicating greater frequency of erratic sleep behavior. Only 10 out of the 15
items on the scale were used to determine the athlete’s score as suggested by the creator: b, c, d, f, g, h, i, j, k, and m. The remaining 5 items were used solely as fillers for the survey.

**Procedures**

The researcher applied for approval by the Institutional Review Board (Appendix C3) at California University of Pennsylvania before distributing the surveys. The research was conducted solely at California University of Pennsylvania in California, Pennsylvania. All of the athletic coaches and the health class professor were contacted to schedule a time for the participants to complete the survey. The researcher met with each individual athletic team and health class to collect the data. The participants were informed that their participation was completely voluntary, they were asked to sign an Informed Consent Form (Appendix C1), and then were asked to complete the SSHS (Appendix C2) to the best of their ability without any help from outside sources. The questionnaire took approximately 5 minutes to complete and was collected by the researcher. The surveys were coded by athletic team with a capital letter such as basketball (K),
soccer (S), golf (G), softball (O), cross country (C), track & field (R), swimming (W), tennis (T), volleyball (V), football (F) and baseball (B). Furthermore, the athletic teams that have both males and females had either an M or W, respectively. For example, men’s soccer was coded as M S and women’s tennis was coded as W T. The surveys were also coded for the health education classes. They were coded as H E D 1 or H E D 2. Once the data had been collected it was sealed in a coded envelope and kept in a secure place that only the researcher had access to. The data was then analyzed using the appropriate statistics on SPSS version 14.0.

Hypotheses

The following hypotheses were based on a review of the literature and the intuition of the researcher.
1. There will not be a difference in sleep deprivation between gender.
2. There will be a difference in sleep deprivation between athletes versus non-athletes.
Data Analysis

The level of significance was set at an alpha level equal to or less than .05 to test the acceptability of the stated hypotheses.

A 2 (gender) x 2 (athletes vs. non-athletes) factorial Multiple Analysis of Variance (MANOVA) was used to determine whether there was a difference in sleep deprivation between males and females, and between athletes versus non-athletes.
RESULTS

Demographic Data

The sample consisted of NCAA Division II athletes (n = 250, 63.9%) and non-athletes (n = 141, 36.1%) from California University of Pennsylvania, for a total of 391 subjects. Within the sample nearly 53% were males (n = 207) and 47% represented females (n = 184). Table 1 depicts the characteristics of the participants from the study.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Range</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-28</td>
<td>19.78 ± 1.56</td>
</tr>
<tr>
<td>Height</td>
<td>59-80</td>
<td>68.86 ± 4.37</td>
</tr>
<tr>
<td>Weight</td>
<td>93-350</td>
<td>170.03 ± 45.10</td>
</tr>
<tr>
<td>BMI</td>
<td>17.0-41.95</td>
<td>24.88 ± 4.71</td>
</tr>
<tr>
<td>GPA</td>
<td>1.3-4.0</td>
<td>3.03 ± .58</td>
</tr>
</tbody>
</table>

For the 250 athletes, their current status of sport was examined and there were 124 (49.6%) in-season and 126 (50.4%) out-of-season athletes. Also, the presence of a disability was examined within the sample and 38 (9.7%) said yes, 352 (90.0%) replied no, and 1 person (0.3%) did
not respond to the question. Table 2 represents the sleep characteristics of the participants from the study.

Table 2. Sleep Characteristics of Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Range</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of sleep on regular school night</td>
<td>2-1040</td>
<td>421.70 ± 84.77</td>
</tr>
<tr>
<td>Time to fall asleep</td>
<td>0-120</td>
<td>29.54 ± 22.35</td>
</tr>
<tr>
<td>Amount of sleep on non-school night</td>
<td>0-870</td>
<td>540.63 ± 125.33</td>
</tr>
<tr>
<td>Average time on school</td>
<td>0-25</td>
<td>4.63 ± 2.61</td>
</tr>
<tr>
<td>Average time on sports</td>
<td>0-15</td>
<td>2.25 ± 1.95</td>
</tr>
<tr>
<td>Average time on work</td>
<td>0-30</td>
<td>1.70 ± 2.81</td>
</tr>
<tr>
<td>Average time on other</td>
<td>0-100</td>
<td>29.54 ± 22.35</td>
</tr>
</tbody>
</table>

Table 3 displays the class rank responses of the subjects.

Table 3. Participants’ Class Rank

<table>
<thead>
<tr>
<th>Class Rank</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>174</td>
<td>44.5%</td>
</tr>
<tr>
<td>Sophomore</td>
<td>94</td>
<td>24.0%</td>
</tr>
<tr>
<td>Junior</td>
<td>84</td>
<td>21.5%</td>
</tr>
<tr>
<td>Senior</td>
<td>36</td>
<td>9.2%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Table 4 represents the subject’s responses to racial/ethnic background. Two subjects chose to not respond to this question.
Table 4. Participants’ Ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>White/Caucasian</td>
<td>315</td>
<td>81.0%</td>
</tr>
<tr>
<td>Black/African American</td>
<td>57</td>
<td>14.7%</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>6</td>
<td>1.5%</td>
</tr>
<tr>
<td>Asian/Asian American</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Multiracial</td>
<td>6</td>
<td>1.5%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Table 5 presents the responses to the number of nights the subject spent in the same bed in the last two weeks. One participant chose to omit this question.

Table 5. Nights of Sleep in the Same Bed

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every Night</td>
<td>149</td>
<td>38.2%</td>
</tr>
<tr>
<td>Almost Every Night</td>
<td>187</td>
<td>47.9%</td>
</tr>
<tr>
<td>A Few Nights</td>
<td>44</td>
<td>11.3%</td>
</tr>
<tr>
<td>Not At All</td>
<td>10</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

A frequency table for the subjects’ opinion of their health is shown in Table 6. One subject chose to omit this question.

Table 6. Opinion of Health

<table>
<thead>
<tr>
<th>Quality</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Fair</td>
<td>31</td>
<td>7.9%</td>
</tr>
<tr>
<td>Good</td>
<td>244</td>
<td>62.6%</td>
</tr>
<tr>
<td>Excellent</td>
<td>112</td>
<td>28.7%</td>
</tr>
</tbody>
</table>

A frequency table representing the number of times the subject wakes up during the night is included as Table 7. There were 6 subjects who chose to omit this question.
Table 7. Number of Times Awaken During Night

<table>
<thead>
<tr>
<th>Number of Times</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>71</td>
<td>18.4%</td>
</tr>
<tr>
<td>Once</td>
<td>166</td>
<td>43.1%</td>
</tr>
<tr>
<td>2 or 3 Times</td>
<td>114</td>
<td>29.6%</td>
</tr>
<tr>
<td>More Than 3 Times</td>
<td>21</td>
<td>5.5%</td>
</tr>
<tr>
<td>I Have No Idea</td>
<td>13</td>
<td>3.4%</td>
</tr>
</tbody>
</table>

A frequency table to represent the subject’s opinion of the quality of sleep achieved is included in Table 8. Three participants chose to omit this question.

Table 8. Opinion of Sleep Quality

<table>
<thead>
<tr>
<th>Quality of Sleep</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too Much Sleep</td>
<td>13</td>
<td>3.4%</td>
</tr>
<tr>
<td>Enough Sleep</td>
<td>210</td>
<td>54.1%</td>
</tr>
<tr>
<td>Too Little Sleep</td>
<td>164</td>
<td>42.3%</td>
</tr>
</tbody>
</table>

Hypothesis Testing

All hypotheses were tested using an alpha level of .05.

Hypothesis 1: There will not be a difference in sleep deprivation between a) gender and b) athletes versus non-athletes.

The following table shows the results of the hypotheses testing using a MANOVA.
Table 9. MANOVA for Gender on SWBT and DST Scores and Athlete v. Non-athlete on SWBT and DST Scores

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWBT*</td>
<td></td>
<td>34.144</td>
<td>1</td>
<td>34.144</td>
<td>.361</td>
<td>.549</td>
</tr>
<tr>
<td>DST*</td>
<td></td>
<td>221.400</td>
<td>1</td>
<td>221.400</td>
<td>2.940</td>
<td>.087</td>
</tr>
<tr>
<td>Athlete v. Non-athlete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWBT*</td>
<td></td>
<td>.084</td>
<td>1</td>
<td>.084</td>
<td>.001</td>
<td>.976</td>
</tr>
<tr>
<td>DST*</td>
<td></td>
<td>175.055</td>
<td>1</td>
<td>175.055</td>
<td>2.325</td>
<td>.128</td>
</tr>
</tbody>
</table>

* SWBT (Sleep-Wake Behavior Problems Scale Score), DST (Daytime Sleepiness Scale Score)

Conclusion: A 2 x 2 factorial MANOVA was calculated examining the effect of gender and athlete v. non-athlete on the SWBT score and the DST score. No significant effect was found for either gender ($\Lambda_{2,386} = .992, P > .05$) or the athlete v. non-athlete ($\Lambda_{2,386} = .994, P > .05$). Neither the SWBT score nor the DST score were significantly influenced by the independent variables gender or athlete v. non-athlete.

Additional Findings

In addition to the hypotheses testing, a Pearson Correlation Coefficient and One-Way Analysis of Variance (ANOVA) tests were performed to investigate other independent variables.
A Pearson Product Moment Correlation was calculated to determine if a relationship between DST score and Body Mass Index (BMI) existed (Table 10).

Table 10. Pearson Correlation for Daytime Sleepiness Scale Score (DST) and Body Mass Index (BMI)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI and DST</td>
<td>386</td>
<td>.114</td>
<td>.025*</td>
</tr>
</tbody>
</table>

* P < .05

Conclusion: A positive correlation was found ($r_{384} = .114$, $P < .05$), indicating a significant linear relationship between the two variables. Subjects with lower DST scores tend to have a lower body mass index.

A Pearson Product Moment Correlation was performed to determine if a relationship between the DST score and a subject’s grade point average existed (Table 11).

Table 11. Pearson Correlation for Daytime Sleepiness Scale Score (DST) and Grade Point Average (GPA)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA and DST</td>
<td>383</td>
<td>-.293</td>
<td>.000*</td>
</tr>
</tbody>
</table>

* P < .001

Conclusion: A negative correlation was found ($r_{381} = -.293$, $P < .001$), indicating a significant linear relationship between the two variables. Subjects with higher GPA Scores tend to have lower DST scores.
A Pearson Product Moment Correlation was calculated to determine if a relationship between DST score and the subjects’ reported usual amount of sleep existed (Table 12).

Table 12. Pearson Correlation for Daytime Sleepiness Scale Score (DST) and Subjects’ Reported Usual Amount of Sleep

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usual Sleep</td>
<td>391</td>
<td>-.106</td>
<td>.037*</td>
</tr>
<tr>
<td>and DST</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .05

Conclusion: A negative correlation was found ($r_{389} = -0.106, P < .05$), indicating a significant linear relationship between the two variables. Subjects with higher amounts of usual sleep reported tend to have lower DST scores.

A Pearson Product Moment Correlation was calculated to determine if a relationship between DST score and the subject’s reported time it takes to fall asleep existed (Table 13).

Table 13. Pearson Correlation for Daytime Sleepiness Scale Score (DST) and Subjects’ Reported Time To Fall Asleep

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Asleep</td>
<td>387</td>
<td>.157</td>
<td>.002*</td>
</tr>
<tr>
<td>and DST</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .01
Conclusion: A positive correlation was found ($r_{385} = .157, P < .01$), indicating a significant linear relationship between the two variables. Subjects with greater reported time it takes to fall asleep tend to have higher DST scores.

A Pearson Product Moment Correlation was calculated to determine if a relationship between DST score and the subject’s reported ideal amount of sleep existed (Table 14).

Table 14. Pearson Correlation for Daytime Sleepiness Scale Score (DST) and Subjects’ ReportedIdeal Amount of Sleep

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>$r$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal Sleep and DST</td>
<td>387</td>
<td>-.103</td>
<td>.042*</td>
</tr>
</tbody>
</table>

* $P < .05$

Conclusion: A negative correlation was found ($r_{385} = -.103, P < .05$), indicating a significant linear relationship between the two variables. Subjects with greater reported ideal amounts of sleep tend to have lower DST scores.

A Pearson Product Moment Correlation was calculated to determine if a relationship between SWBT score and DST score existed (Table 15).
Conclusion: A positive correlation was found ($r_{389} = .227$, $P < .001$), indicating a significant linear relationship between the two variables. Subjects with higher SWBT scores tend to have higher DST scores.

A one-way ANOVA was computed comparing the DST score among sports. A significant difference was found among the sports ($F_{14,235} = 1.94$, $P < .05$). Table 16 presents the results of one-way Anova.

Tukey’s HSD was used to determine the nature of the differences between the sports. This analysis revealed that there were significant differences between many of the
sports for their DST scores. The means and standard deviations are represented in Table 17, and Figure 1.

Table 17. Data Table for Each Sports’ Mean and Number of Subjects for DST Score

<table>
<thead>
<tr>
<th>Sport</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men’s Cross Country</td>
<td>6</td>
<td>16.33</td>
<td>2.73</td>
</tr>
<tr>
<td>Men’s Track &amp; Field</td>
<td>8</td>
<td>19.38</td>
<td>6.05</td>
</tr>
<tr>
<td>Women’s Track &amp; Field</td>
<td>8</td>
<td>20.88</td>
<td>10.55</td>
</tr>
<tr>
<td>Women’s Tennis</td>
<td>8</td>
<td>21.63</td>
<td>4.69</td>
</tr>
<tr>
<td>Women’s Soccer</td>
<td>20</td>
<td>21.70</td>
<td>8.22</td>
</tr>
<tr>
<td>Men’s Golf</td>
<td>10</td>
<td>22.40</td>
<td>9.90</td>
</tr>
<tr>
<td>Women’s Golf</td>
<td>7</td>
<td>22.57</td>
<td>11.16</td>
</tr>
<tr>
<td>Swimming</td>
<td>9</td>
<td>22.78</td>
<td>8.12</td>
</tr>
<tr>
<td>Softball</td>
<td>20</td>
<td>23.30</td>
<td>6.00</td>
</tr>
<tr>
<td>Volleyball</td>
<td>11</td>
<td>25.55</td>
<td>7.38</td>
</tr>
<tr>
<td>Women’s Basketball</td>
<td>12</td>
<td>26.25</td>
<td>10.62</td>
</tr>
<tr>
<td>Football</td>
<td>67</td>
<td>28.01</td>
<td>10.98</td>
</tr>
<tr>
<td>Men’s Soccer</td>
<td>19</td>
<td>28.21</td>
<td>10.01</td>
</tr>
<tr>
<td>Men’s Basketball</td>
<td>14</td>
<td>28.21</td>
<td>6.77</td>
</tr>
</tbody>
</table>
A one-way ANOVA was computed comparing the DST scores between season status. A significant difference was found between season status ($F_{1,248} = 4.51$, $P < .05$). Tukey’s HSD was used to determine the nature of the differences between In-season and Out-of-season. This analysis revealed that the Out-of-season athletes had higher DST scores ($26.45 \pm 10.16$) than In-season athletes ($23.90 \pm 8.79$). The results of the ANOVA are shown in Table 18 and Figure 2.
Table 18. A One-Way ANOVA for DST Scores between Season Status

<table>
<thead>
<tr>
<th>DST</th>
<th>Type III</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>408.69</td>
<td>1</td>
<td>408.69</td>
<td>4.52</td>
<td>.035*</td>
</tr>
<tr>
<td>Within Groups</td>
<td>22442.85</td>
<td>248</td>
<td>90.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22851.54</td>
<td>249</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* P < .05

Figure 2. Box Plot representing Mean Daytime Sleepiness Scale Scores (DST) between Season Status
DISCUSSION

In the discussion of the study findings, the following sections are presented: 1) Discussion of Results, 2) Conclusions, and 3) Recommendations.

Discussion of Results

This study focused on sleep habits of NCAA Division II college students through an investigation to determine if any differences existed between gender and athlete versus non-athlete status. Sleep is an important physical process that the human body requires for adequate functioning in every day life. The psychological and physiological process of sleep provides a time in which the body can regenerate from the stress it endures during waking hours. Lack of sleep will lead to the development of a sleep debt. The accumulation of sleep loss will cause the sleep debt to grow allowing the opportunity for serious problems to occur.

Sleep deprivation has been linked directly to decreases in performance. As a cause of decreased mental acuity sleep deprivation can also negatively affect growth and the ability to learn in human beings.
deficits in the school systems have been found as a direct result of sleep deprivation. Students experience difficulty learning and retaining information when they allow their sleep habits to be interrupted and shortened. The health and well-being of the public is also at risk when they lose sleep. The more sleep deprived a person is, the more likely they are to engage in risk-taking behaviors. Sleep deprivation can also impair motor function, delay visual and auditory reaction time, reduce cardiovascular performance, and diminish mental functioning during athletic performance. Sleep deprivation can cause a great deal of deficits physically, mentally, and emotionally in human beings and as a result, more research must be conducted to determine all of its effects.

Athletes sustain a far greater amount of stress to their bodies than non-athletes in the college/university setting. As a result of this stress, whether it is physical, mental, or emotional, athletes require a greater amount of sleep or time to regenerate their body. This belief is the motivation for this investigation about the sleep habits of athletes and non-athletes. At the institution where the subject’s were used, there was no difference in the amount of sleep obtained by athletes and non-athletes. If athletes are getting the same amount of
sleep as the non-athlete subjects, then they may not be getting enough sleep to recuperate from the stresses they sustain. Football is a sport that puts the body through a great deal of physical, mental, and emotional stresses, that are comparable yet different to the stresses sustained in cross country. Football players reported significantly higher Daytime Sleepiness Scale (DST) Scores than the men’s cross country athletes did. Higher DST Scores mean a greater amount of sleep deprivation which shows that athletes who need more sleep are not getting it.

The men’s basketball and men’s soccer teams also showed significantly higher DST scores than the men’s cross country team. Cross country is a sport that requires a great deal of commitment year round. These athletes are never truly out of season because they are always running incredibly long distances to stay in shape. Both basketball and soccer are sports that require a greater deal of physical toughness but there is a period of time where they will not engage in sport specific training. As a result of the physical toll that a sport like cross country has on its athletes, it is important they are never at risk for sleep deprivation.

This study found that gender does not have any affect on the outcome of sleep deprivation. This finding is very
important because it shows that neither men nor women are more apt to sleep deprivation. However, how does this explain that the only significant differences in sleep deprivation were for male sports? It is the perception of society that males are more aggressive and physical than females. Taking this into account for today’s sports may explain why soccer could be consider as more physical when played by men than women.

The hypotheses of this study did not show any significant findings, but the most interesting and important results were found within the additional findings. Several different correlations, both positive and negative, were found between variables within the study. First, subjects with lower DST scores tended to have lower body mass index. This finding is very critical because obesity is a known cause of sleep deprivation.\footnote{Overweight individuals are more prone to sleep apnea or interrupted breathing patterns during sleep. This will cause the individual to awake several times throughout the night taking away from the amount of sleep they get. This information can be used to put a greater emphasis on the importance of exercise and proper nutrition.}

Another significant correlation that the study found was the subjects who reported greater amounts of time as
their ideal amount of sleep, had lower DST scores. These subjects that sleep longer know the importance of giving their body adequate time to recover. This information is evident by the fact that they had lower DST scores showing that they were less sleep deprived than those who reported lesser amounts of ideal sleep time. This is an important finding because it is logical information for the public. If an individual sleeps more or has a greater amount of time that is ideal for sleep, then the person is less likely to be sleep deprived. People need to make sleep a higher priority in their daily lives to prevent deficits from occurring in their performance as a result of sleep deprivation.

The study also found that subjects with higher GPA’s were found to have lower DST Scores. If GPA is a valid predictor of a person’s level of intelligence then, those who are more aware of the importance of sleep, have the ability to perform better mentally. With evidence such as this, educational institutions can use it to promote better sleep habits. With emphasis on need for better sleep, it could be motivation for those with lower GPA scores to make sleep a higher priority. A rearrangement of priorities could make a difference in their educational performance.
Another important correlation in this study was the subjects with higher amounts of time that they usually sleep tend to have lower DST scores. Research has shown that the body needs 10 hours and not 8 hours of sleep to recover from a full day of wakefulness.\(^1\) Whether you are an adolescent, middle-aged, or elderly person, the more sleep that you get on a regular basis, the less likely you are to be sleep deprived. This is a very basic finding but it is proof of the importance of reiterating the need for sleep in all aspects of education. The sooner this information can be emphasized in greater depth, the sooner there could be a decline in negative outcomes as a result of sleep deprivation.

The study also found an important correlation between the time it takes to fall asleep and DST scores. Subjects who reported a longer time it took for them to fall asleep at night were more sleep deprived. It is important for people, athletes especially, to go to sleep when they are tired and to avoid waiting around for a “second wind” or using caffeine to keep them up at night. Eating and being active late at night can increase the time it takes for a person to fall asleep once they get into bed.\(^1\) For this reason, it is important that one participates in better sleep promoting practices at night. Avoiding eating,
drinking, smoking, and exercise late at night will help to prevent an increase in time it takes to fall asleep once in bed. These are practices that can be incorporated into our daily lives without any difficulty and would be very beneficial. A decrease in the time it takes to fall asleep will help decrease the amount of sleep deprived people in the world creating a healthier and more productive society.

One of the most important correlations found in this study was the relationship between the two sleep scales that were used to measure sleep deprivation. The study found that subjects with higher Sleep-Wake Behavior Problems Scale (SWBT) scores tended to have higher DST scores. This establishes the validity and reliability for these two sleep scales as being predictors for sleep deprivation. These scales are easy to use and find over the internet. Institutions and organizations everywhere should use them to measure and track the sleep deprivation levels of their members. Tracking sleep deprivation levels could lead to the prevention of decline in productivity and money by ensuring the institutions and organizations are performing at an optimal level.
Conclusions

This study demonstrated that the sleep habits of NCAA Division II athletes are no different than those of non-athletes at the same institution. These findings are important because it shows that athletes do not require more sleep than non-athletes do. Furthermore, this study found that there are no differences in sleep habits between gender. All human beings are at risk of becoming sleep deprived and need to be made aware of it. A worldwide education program needs to be implemented to inform as many people as possible about the importance of sleep and the deficits in performance that can develop as a result of lack of sleep.

Education beginning at a young age can imbed the information into young minds. Ensuring that proper amounts of sleep are obtained from an early age has the potential to increase the mental abilities of everyone. Proper sleep habits can lead to an increase in standardized testing, institutional GPA’s or even business generated revenue.

This study has implications to the profession of athletic training because of significant differences in sleep deprivation between sports. Men’s basketball, men’s soccer, and football are the sports in which athletes are
likely to become sleep deprived. This is important because athletic trainers can use this evidence to develop educational programs for all athletes, especially those at higher risk. These education programs can require that the athletes keep sleep logs or measure their sleep deprivation on a regular basis to monitor any risk. Prevention is one of the five domains the athletic training profession is built and prevention of sleep deprivation can lead to the improved health, better decision making, and increased athletic performance.

Recommendations

While this study investigated the sleep habits of athletes and non-athletes, the athletes were surveyed one time. They were surveyed during the month of February which is a time when many athletes who are out-of-season may have an altered participation schedule. Also, those athletes who are in-season are close to the end of their sport’s season and may also have an altered participation schedule due to post-season competition. As a result of the timing, it is important that athletes are surveyed about their sleep habits more frequently. They should be surveyed at least three times throughout the school year: once at week eight
of the fall semester (beginning to mid-October), once at week two of the spring semester (mid- to late January), and once at week ten of the Spring semester (mid-to late April). These surveying times will account for all seasons of the athletes sport: in-season, out-of-season, and the in-between season.

Another recommendation for future research would be to involve more institutions at different levels. Not just NCAA Division II but I and III, and schools from all over the United States ranging from small to large population sizes. This recommendation will help find more similarities and differences in the sleep habits of athletes and non-athletes across regions, gender, sport and many other important variables. Once an understanding of sleep deprivation has been determined across the United States, then the sporting world can be influenced positively to maximize the optimal performances generated by athletes.
REFERENCES


APPENDICES
APPENDIX A

Review of the Literature
This review of literature will examine the sleep habits of NCAA Division II athletes and non-athletes. Sleep is an important physiological and psychological requirement for the human body to perform at an optimal level. Currently, there is not much research in circulation regarding this topic. This review will examine the current research that discusses the effects of sleep deprivation on the athletic body. It will be divided into three main sections: 1) Sleep 2) Sleep Deprivation and 3) Current Research. A summary of the review of the literature will also be provided.

Sleep

Sleep is a physiological process that allows for the human body to rejuvenate itself. It is through this process that the body repairs muscle, stores complex information in our memory banks, and repairs our immune system from damage suffered by invaders. The actual physiological process of sleep is considered a cycle that usually lasts about 90 minutes in duration. A sleep cycle consists of different
stages and the cycle is repeated several times in a normal sleeping period.

A normal sleeping period is considered to be about 7 to 8 hours which is the average amount of sleep reported by the general population. Recent research has found that on average, the general population should try to obtain about 10 hours of sleep a night. Each of the different sleep stages are able to be detected by monitoring brainwave activity while a person is sleeping. Through the use of a polysomnography, researchers are able to record a person’s brain activity while sleeping.

The different sleep stages are known as stage 1, stage 2, stage 3, stage 4, and REM stage.\(^1\) Stage 1 sleep is considered to be light sleep marked by theta brain waves. In this stage our heart rates slow and our breathing becomes shallow but regular. Stage 1 sleep is when people tend to experience sudden relaxation of the skeletal muscles causing a sudden jerk, awakening them. This stage can last anywhere from 10 seconds to 10 minutes.

In stage 2 sleep, the theta brain waves begin to show what are known as k-complex waves and sleep spindles. These are single waves with high-amplitude and 12 to 14 cycle-per-second waves. In stage 2 sleep researchers say that we
become disengaged from the environment, beginning sleep. This stage typically lasts about 10 to 20 minutes.

Stage 3 sleep brain activity shows a combination of theta and delta (low frequency, high-voltage) waves. The theta brain waves disappear in a short amount of time revealing that stage 4 sleep has been reached. Stage 3 and stage 4 sleep tend to be grouped together into one stage because of the relatively quick disappearance of the theta brain waves.² This is the deepest stage of all the stages of sleep. In this sleep stage blood pressure drops, pulse and respiration rate slow down, and muscle relaxation occurs. This sleep stage lasts anywhere between 30 to 40 minutes.

Stage 4 sleep is such an important stage of sleep because it is when the body restores, grows, and maintains our general health. Blood flow to the muscles is increased, body temperature decreases, metabolic activity is slowed and growth hormone is secreted by the pituitary gland. These physiological changes that occur in our body allow us to conserve energy and grow and repair tissue. Also in this sleep stage, two cytokines are released in the body to help restore the immune system.² Cytokines are chemicals released in the body that signal different physiological changes. These two cytokines that are released in the body during stage 4 are interleukin and tumor necrosis factor.
After about 90 to 110 minutes have passed since falling asleep, we begin to move backwards through the sleep stages from 4 to 2.¹ From this point the body begins to undergo a sympathetic nervous stimulation that causes an increase in blood flow to the brain, and in pulse rate, respiration rate, and blood pressure. The eyes begin to move around quickly while the eyelids are closed. This stage is known as stage 1 REM (rapid-eye-movement) sleep. Stage 1 REM sleep can last up to ten minutes and it is the stage where we experience our most vivid and emotional dreams. Also in this stage, neuronal messages are blocked from the motor cortex at the brain stem allowing the body to be completely relaxed and unable to move.²

Stage 1 REM sleep is an important physiological stage of sleep because it is when our brain stores, retains, organizes and reorganizes information in our memory. In stage 1 REM sleep the brain is extremely active and fires several neurons in the brain stem.² This process is believed to be the way that our memory stores, retrieves, reorganizes and categorizes information.¹ During stage 1 REM sleep, random neuronal pathways are fired that hold information and experiences.² This random firing strengthens these memory neurons, making the information or experience repeat itself in the brain.
After stage 1 REM is over, the brain goes back through stage 2 and stage 3 sleep to reach stage 4. After reaching stage 4, the brain goes back again to stage 1 REM sleep beginning the next cycle of sleep. Each cycle takes anywhere between 90 to 110 minutes and a night’s sleep will usually consist of four to five cycles before awakening.

Sleep Deprivation

A great amount of time and effort has been spent studying sleep habits and how they affect our everyday life. A lack of sleep can easily be detected in a person by a lack of alertness, energy and focus. Those who may not experience fatigue or lack of focus are still at a great risk of becoming sleep deprived. Our sleep need is regulated by a homeostatic drive so it ensures that we get enough sleep to allow us to function properly during the day. An average waking day will consist of 16 hours, so our homeostatic sleep drive will ensure that we sleep for 8 hours to recover. Our sleep drive is also controlled in combination with our circadian rhythms. The circadian rhythm is a function of our biological clock that controls levels of alertness, body temperature, and hormone secretion. These physiological and psychological changes
occur every 24 hours which is how the term circadian rhythm was derived.

It’s easy to offset the two parts of our sleep drive when we stay up later than usual on any given night. When these cycles are set off track, we develop what is known as a sleep debt. Sleep debt is developed from daily activities. A full day of wakefulness lasting 16 hours generates a sleep debt of 8 hours which must be paid to ensure optimal performance for the next day. By staying up 18 or 20 hours in a day, that increases the sleep debt by 2 or 4 hours. Over 100 million Americans incur a sleep debt every night proving how easy it is to develop.

Developing a sleep debt not only disrupts a person’s level of alertness, body temperature, or hormonal cycles. It also can prevent the body’s ability to function at a high or optimal level of performance. During the time that we sleep, the body grows and repairs tissue. If adequate time is not given for the body to carry-out these physiological processes, it will weaken the tissue, opening a window of susceptibility for injury. Also a window of susceptibility is opened for developing illness because of a weakened immune system. If an inadequate amount of cytokines are produced because of a decrease in time slept, it will cause the immune system to become run down,
increasing the risk of infection. A sleep debt can even disturb glucose metabolism, impairing performance and recovery further.\textsuperscript{3}

All of these effects can easily be prevented by adhering to a few simple guidelines. Try to keep a regular sleep schedule that is consistent. Stay away from consuming beverages at night that have caffeine in them. Create a comfortable sleeping environment that is dark and quiet, and avoiding studying, reading, or watching television in bed. Regular exercise during the day is also beneficial for sleeping well at night so long as it isn’t within 3 hours of your bedtime.

The constant rise in sleep debt is a direct result of the fact that our modern society is a 24 hour, non-stop society. Between family obligations and social events, the day is filled with long hours of wakefulness causing irregular sleep-wake schedules. A great example of this gradual change is the common saying that people often use, “there are not enough hours in the day”. As a result people are staying up longer and sleeping less to get everything done. People often go several days without sleep and can suffer some serious detrimental effects such as hallucination, slowed reflexes, impaired judgment and hostility.\textsuperscript{2} Sometimes people can’t sleep not by choice, but
as a result of a sleep disorder. Over 40 million Americans suffer from some kind of sleep disorder with an additional 20 to 30 million suffering from intermittent sleep-related problems.\textsuperscript{2}

Early recognition and treatment of sleep disorders are extremely important because chronic ailments have led to serious problems. As a result of daytime drowsiness; mood shifts, weight gain, lethargy, and reduced productivity are affects of sleep deprivation that lead to serious problems such as accidents at work, plane crashes, death of kin, and serious natural disasters.\textsuperscript{2} Sleep deprivation and sleep debt can easily be avoided and corrected by prioritizing the day. At the top of the list must be going to sleep at a reasonable time, as well as awaking at a reasonable time. Sleep deprivation can cause serious problems and concerns in our society and it is important that we stop them from ever occurring.

**Current Research**

There is very minimal literature in circulation that discusses the effects of sleep deprivation on athletes. The majority of the research is directed towards the effects of sleep deprivation on mostly the adolescent, but also on the
elderly population. The most concrete literature in circulation discusses effects of sleep deprivation on circadian rhythms, behavior, daytime functioning, memory recognition, and hormone production. The major cause of circadian rhythm disruption has been found to be due to the requirements of schooling, in the adolescent population. Early school start times and late nights filled with school work are causing great sleep debts. Adolescents are trying to repay their sleep debts on the weekends causing a large shift in their circadian rhythms. The irregular sleep wake cycles lead to decreases in academic performance. The disruption of circadian rhythms and the increase of sleep debt, lead to greater risk-taking behaviors in adolescents. Early implementation of an adequate sleep education program could lead to the prevention of disrupted circadian rhythms, increasing sleep debts, decreases in academic performance, and increase in risk-taking behaviors.

The disrupted circadian rhythms leading to increasing sleep debts can cause those who are sleep deprived to be fatigued. Fatigue has several negative effects on performance such as cognitive slowing, decline in motivation, impaired memory, decrease in learning and decay in problem solving. As a result of such negative effects,
both academic and athletic performance are affected.\textsuperscript{10} The impairment of memory as a result of fatigue is a serious negative effect that is detrimental to athletes. Sleep has been found to enhance the consolidation of memories throughout the various sleep stages.\textsuperscript{11} Storing of memory can greatly enhance learned skills. During REM sleep learned skills are often rehearsed, placing that skill in higher memory banks allowing for future recall to be made subconsciously.

When circadian rhythms are disrupted, the secretion of several different hormones are offset as well. The secretion and clearance cycles of hormones such as glucose, insulin, cortisol and growth hormone are disturbed as a result in the change of the circadian rhythms.\textsuperscript{12,13} Although there is minimal research that looked at the effects of these altered hormone cycles, they can greatly affect tissue repair. With inadequate amounts of hormones present in the body, the necessary physiological functions will be prevented or slowed, affecting a person’s performance.

Although, many of these results have been determined from studies conducted on the general public, similar results have been found in studies involving athletes, exercise and performance. Several researchers have directed their work towards determining the relationship between
circadian rhythms and exercise. Along with the body’s natural sleep-wake cycle, the body temperature cycle is important to our daily physiological processes.\textsuperscript{14-16} Research has found that there is an ideal time to be physically active in concordance with both our circadian rhythm and body temperature cycle. This may allow for the development of an optimum time for athletic performance to take place.\textsuperscript{17} But, by disrupting our circadian rhythms, we not only disrupt our body temperature cycle, but also the ability to have a peak performance time during the day. This is one of the beliefs that accompany the research on the effects of travel on athletic performance. Long distance traveling can lead to jet lag by a change of as little as a 3 hour shift in sleep-wake cycle.\textsuperscript{15,18} This shift can cause a significant adjustment problem for athletes in attempting to realign their circadian rhythm.

Sleep deprivation is difficult to study in relation to its effects on an athletic population because of the various numbers of variables that can be studied. Sleep deprivation causes impaired motor function, delayed visual reaction time, delayed auditory reaction time, reduced cardiovascular performance, and reduced endurance.\textsuperscript{19} These physiological effects of sleep deprivation are essential to performing at an optimal level in the sporting world. A
professional athlete has to rely strongly on visual and auditory reaction time, as well as motor function, cardiovascular performance and endurance. It is important that these physiological abilities are working at their utmost optimal level possible. Sleep deprivation will prevent the athlete from performing at their highest level possible for each of these physiologic abilities because of an inadequate amount of recovery time.\textsuperscript{20}

A large part of athletics is the preparation for high-level competition. One of the ways athletes most commonly prepare is through weight-lifting. Research has been conducted to measure the effects of sleep deprivation on weight-lifting performance. Studies have found that sleep deprivation affects certain maximal effort weight-lifting techniques such as bench press, leg press and dead lift.\textsuperscript{21} If an athlete is sleep deprived they won’t be able to develop an adequate amount of strengthening through weight-lifting exercises, leading to an inability to perform at an optimal level.

Another part of athletics that prepares an athlete for competing at the highest level is to perform at a high VO\textsubscript{2} max. Research has shown that an athlete who is sleep deprived will perform at a lower running economy or VO\textsubscript{2} max than an athlete who isn’t sleep deprived.\textsuperscript{22} This will
greatly decrease the time that the athlete can perform at their optimal level, allowing for the highest level of competition.

What seems to be a growing fad in athletics is the purchasing of hyperbaric chambers for an athlete to sleep in. In a hyperbaric chamber, the air is set to that of an increased altitude decreasing the partial pressure of oxygen in the air.\textsuperscript{23} The rationale behind this is that increased altitude will increase oxygen transport capacity of the blood. This can improve an athlete’s performance because more oxygen can be brought to their muscles, in a shorter amount of time. This is a hot topic in sports currently because there have been several spotlights on ESPN television about professional and college athletes that sleep in hyperbaric chambers. However, there is current literature that shows that sleeping at increased simulated elevations cause sleep disturbances in athletes.\textsuperscript{24} With this being the case it is absolutely essential that further research is conducted because what is believed to be helpful for an athlete’s performance, may actually be hindering it.
Summary

Sleep is a very important physiological and psychological requirement for the human body to perform at an optimal level. Sleep is essential for optimal performance in both academics and athletics. It is the process in which our body recovers from a full day of wakefulness. Without sleep we begin to develop a sleep debt which can cause serious psychological and physiological detriments.

Sleep deprivation has a direct effect on a person’s ability to function. Sleep deprivation causes fatigue and lack of focus which in turn cause more severe cognitive impairments. Not only are cognitive impairments at risk, but sleep deprivation can generate a window of susceptibility for injury in strenuous event, such as athletic competition.

There has not been a great deal of research that has been conducted to examine the effects of sleep deprivation on athletics. Sleep deprivation is easily accumulated by humans in their everyday life. As a result, it is important to understand how it will affect the athletic world. Once it is understood how sleep deprivation affects athletes, we will hopefully be able to develop the proper education
needed to prevent further sleep deprivation, and maximize optimal athletic performance, naturally. But, before this can be accomplished we first must determine the sleep habits of athletes to see if they are putting themselves at risk.
APPENDIX B

The Problem
The Problem

Statement of the Problem

Sleep research has found that over 100 million Americans are unable to get a good night’s rest every night. Among this increasingly sleep-deprived population, high school and college students are the largest demographic group that are sleep-deprived. The purpose of this study is to examine the sleep habits of NCAA Division II athletes and non-athletes.

Definition of Terms

The following terms were used throughout the study, and, therefore, are defined as they pertain to this specific research:

1) Athletes- Division II intercollegiate varsity participants from California University of Pennsylvania.

2) Circadian Rhythm- a 24 hour sleep-wake cycle that is maintained by the body’s drive for homeostasis.

3) Non-athletes- Students that are not considered Division II intercollegiate varsity participants from California University of Pennsylvania.
4) School Sleep Habits Survey (SSHS) - a survey used to measure a variety of sleep problems and behaviors.\textsuperscript{19,25}

5) Sleep Deprivation - a lack of sleep that can lead to several cognitive, psychological and physiological deficits.

**Basic Assumptions**

The following were the basic assumptions for this particular study:

1) The subjects answered all questions on the survey accurately, individually, and honestly to the best of their knowledge.

2) All of the athletes listed on each team’s roster will complete a copy of the survey.

3) The Questionnaire is reliable.

**Limitations of the Study**

The following are the limitations of the study:

1) The non-athletes selected as a convenience sample from Health Education classes may not be the best sample to use as a reflection of the general non-athlete population.

2) The athlete population is selected from a single Division II University/College.
3) The athletes selected will be either in season or out of season.

Significance of the Study

Sleep plays a major role in preparing the body and brain to be alert and productive both psychologically and physiologically. It allows for our bodies to rejuvenate itself after a full day of physical and mental exertion. Previous research has examined the effects of sleep deprivation on shift workers, exercise and physician performance. All of these variables that have been studied show that sleep deprivation has a negative affect on performance no matter what your performance environment may be. The affects of sleep deprivation on athletic performance has not been studied in depth to this point in time. Sports have become an increasingly growing business in our society because of the development of several professional sports organizations. Athletes who are a part of these organizations want to make themselves the best athletes that they can be in every aspect of their respective game. Sleep being a large factor in increasing the performance level of shift workers and physicians; it should have a similar affect on athletes, especially at the collegiate level. College students are considered to be one
of the most sleep deprived demographic groups in the world. They are also the future talent and revenue of these professional sport organizations. By surveying samples of college athletes about their sleeping habits, the severity of sleep deprivation will be determined. From this, it may be possible to determine if there are any correlations with the athlete or a team’s performance during their season. Also, the greater an athlete’s sleep deprivation is, the more likely they may be at injuring themselves during participation in their sport.
APPENDIX C

Additional Methods
APPENDIX C1

Informed Consent
Informed Consent Form

1. “James Pratt, who is a graduate assistant at California University of Pennsylvania, has requested my participation in a research study at this institution. The title of the research is The Sleep Habits of NCAA Division II Athletes and Non-athletes.”

2. “I have been informed that the purpose of the research is to examine the sleep habits of athletes and non-athletes.”

3. “My participation will involve answering a 19-question survey.”

4. “There are no foreseeable risks or discomforts by participating in this study.”

5. “There are no feasible alternative procedures available for this study.”

6. “I understand that the possible benefits of my participation in the research are enhancing the understanding and knowledge of the effects of sleep deprivation on athletes and non-athletes.”

7. “I understand that the results of the research study may be published but that my name or identity will not be revealed. In order to maintain confidentiality of my records, James Pratt will maintain all documents in a secure location in which only the student researcher and research advisor can access.”

8. “I have been informed that I will not be compensated for my participation.”

9. “I have been informed that any questions I have concerning the research study or my participation in it, before or after my consent, will be answered by James Pratt, 265 California Rd, Brownsville PA 15417. (203)509-9051. pra5744@cup.edu or Dr. Carol Biddington, biddington@cup.edu.”

10. “I understand that written responses may be used in quotations for publication but my identity will remain anonymous.”
11. “I have read the above information. The nature, demands, risks, and benefits of the project have been explained to me. I knowingly assume the risks involved, and understand that my participation is voluntary and I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waiving any legal claims, rights, or remedies. A copy of this consent form will be given to me upon request.”

Subject Signature _________________________ Date __________

12. “I certify that I have explained to the above individual the nature and purpose, the potential benefits, and possible risks associated with participation in this research study, have answered any questions that have been raised, and have witnessed the above signature.”

13. “I have provided the subject/participant a copy of this signed consent document if requested.”

Investigator’s Signature _______________________ Date __________

*Approved by the California University of Pennsylvania IRB*
APPENDIX C2

Abbreviated Version of the School Sleep Habits Survey (SSHS)
School Sleep Habits Survey

INSTRUCTIONS

Please answer the following questions as accurately and honestly as you can. There are no right or wrong answers.

- Do not spend too much time on any one answer. Your first impression is usually best.
- Be sure to complete BOTH SIDES of every page.

1. What is your class rank?
   a. freshman
   b. sophomore
   c. junior
   d. senior
   e. other
   if other, explain ______________________________.

2. What is your gender?
   a. male
   b. female

3. What is your height?
   ____ feet
   ____ inches

4. What is your weight?
   ____ pounds

5. What is your age?
   ____ years-old

6. What is the current status of your sport?
   ____ in-season
   ____ out-of-season

7. What is your approximate grade point average (GPA)?
   ____

8. What best describes your racial/ethnic background?
   a. White/Caucasian
   b. Black/African American
   c. Hispanic/Latino
   d. Asian/Asian American
   e. Native American/Amerindian
   f. Multiracial (please specify)
   __________________
   g. Other (please specify)
   _________________

9. In the last two weeks, have you slept in the same bed?
   a. Every night
   b. Almost every night
   c. A few nights
   d. Not at all

10. Compared to other people your age, would you say your health is:
    a. Poor
    b. Fair
    c. Good
    d. Excellent
11. Do you have any disabilities or chronic illnesses (for example, asthma, diabetes, deafness, loss of the use of a limb, etc.)?
   a. Yes
   b. No

12. Figure out how long you usually sleep on a normal school night and fill it in here. [Do not include time you spend awake in bed. Remember to mark hours and minutes, even if minutes are zero.]
   ____ hours ____ minutes

13. Some people wake up during the night. Others never do. How many times do you usually wake up at night?
   a. Never
   b. Once
   c. 2 or 3 times
   d. More than 3 times
   e. I have no idea

14. How many hours per day do you spend on average on:
   School _____       Sports _____
   Work _____       Other _____

15. On school days, after you go to bed at night, about how long does it usually take you to fall asleep?
   _____ minutes

16. Figure out how long you usually sleep on a night when you do not have school or work the next day (such as a weekend night) and fill it in here. [Do not include time you spend awake in bed. Remember to mark hours and minutes, even if minutes are zero.]
   _____ hours _____ minutes

17. In general, do you feel you usually get...
   a. too much sleep?
   b. enough sleep?
   c. too little sleep?

*Approved by the California University of Pennsylvania IRB*
18. During the last two weeks, have you struggled to stay awake (fought sleep) or fallen asleep in the following situations? (Mark one answer for every item.)

Both struggled to stay awake and fallen asleep

Fallen asleep

Struggled to stay awake

No

- in a face-to-face conversation with another person? ........................................... ○ ○ ○ ○ ○
- traveling in a bus, train, plane or car? ........ ○ ○ ○ ○ ○
- attending a performance (movie, concert, play)? ........................................... ○ ○ ○ ○ ○
- watching television or listening to the radio or stereo? ........................................... ○ ○ ○ ○ ○
- reading, studying or doing homework? ........ ○ ○ ○ ○ ○
- during a test? ........................................... ○ ○ ○ ○ ○
- in a class at school? ........................................... ○ ○ ○ ○ ○
- while doing work on a computer or typewriter? ........................................... ○ ○ ○ ○ ○
- playing video games? ........................................... ○ ○ ○ ○ ○
- driving a car? ........................................... ○ ○ ○ ○ ○

Do you drive? ○ Yes ○ No

19. In the last two weeks, how often have you...
(Mark one answer for every item.)

Never

Twice

Several times

Everyday/night

a. felt satisfied with your sleep? .................. ○ ○ ○ ○ ○
b. arrived late to class because you overslept? .................. ○ ○ ○ ○ ○
c. fallen asleep in a morning class? .......... ○ ○ ○ ○ ○
d. fallen asleep in an afternoon class? .... ○ ○ ○ ○ ○
e. awakened too early in the morning and couldn’t get back to sleep? .................. ○ ○ ○ ○ ○
f. stayed up until at least 3 a.m.? .............. ○ ○ ○ ○ ○
g. stayed up all night? ............................... ○ ○ ○ ○ ○
h. slept in past noon? ............................... ○ ○ ○ ○ ○
i. felt tired, dragged out, or sleepy during the day? .................. ○ ○ ○ ○ ○
j. needed more than one reminder to get up in the morning? .................. ○ ○ ○ ○ ○
k. had an extremely hard time falling asleep? .................. ○ ○ ○ ○ ○
l. had nightmares or bad dreams during the night? .................. ○ ○ ○ ○ ○
m. gone to bed because you just could not stay awake any longer? .................. ○ ○ ○ ○ ○
n. done dangerous things without thinking? .. ○ ○ ○ ○ ○
o. had a good night’s sleep? .................. ○ ○ ○ ○ ○
APPENDIX C3

IRB Human Subjects Form
PROTOCOL for Research Involving Human Subjects

Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects

(Reference IRB Policies and Procedures for clarification)

Project Title: The Sleep Habits of NCAA Division II Athletes and Non-Athletes
Researcher/Project Director: James Pratt
Phone #: (203) 509-9051
E-mail Address: PRA5744@cup.edu
Faculty Sponsor (if required): Dr. Carol Biddington
Department: Health and Sport Sciences
Project Dates: January 2007 to March 2007
Sponsoring Agent (if applicable):
Project to be Conducted at: California University of Pennsylvania
Project Purpose: Thesis

Required IRB Training
The training requirement can be satisfied by completing the online training session at http://irb.uc.edu. A copy of your certification of training must be attached to this IRB Protocol. If you have completed the training at an earlier date and have already provided documentation to the California University of Pennsylvania Grants Office, please provide the following:

Previous Project Title:
Date of Previous IRB Protocol:

Approved, September 12, 2005
Please attach a typed, detailed summary of your project AND complete items 2 through 6.

1. Provide an overview of your project-proposal describing what you plan to do and how you will go about doing it. Include any hypothesis(es) or research questions that might be involved and explain how the information you gather will be analyzed. For a complete list of what should be included in your summary, please refer to Appendix B of the IRB Policies and Procedures Manual.

   The purpose of this project is to determine the Sleep Habits of Division II Athletes and Non-athletes. Athletes and non-athletes from California University of Pennsylvania will be asked to complete the School Sleep Habits Survey. The hypotheses of the study are as follows: 1) There will be no difference between gender for sleep habits, and 2) There will be a difference between athletes versus non-athletes for sleep deprivation. A 2 x 2 factorial MANOVA will be used to determine if there is a difference in the sleep habits between males and females, and between athletes versus non-athletes.

2. Section 46.11 of the Federal Regulations state that research proposals involving human subjects must satisfy certain requirements before the IRB can grant approval. You should describe in detail how the following requirements will be satisfied. Be sure to address each area separately.

   a. How will you insure that any risks to subjects are minimized? If there are potential risks, describe what will be done to minimize these risks. If there are risks, describe why the risks to participants are reasonable in relation to the anticipated benefits.
      i. There are no foreseeable risks.

   b. How will you insure that the selection of subjects is equitable? Take into account your purpose(s). Be sure you address research problems involving vulnerable populations such as children, prisoners, pregnant women, mentally disabled persons, and economically or educationally disadvantaged persons. If this is an in-class project describe how you will minimize the possibility that students will feel coerced.
      i. The subjects will consist of athletes in every sport at California University of Pennsylvania. The non-athletes will consist of a convenience sample chosen from Health Education classes at California University of Pennsylvania. Participation will be completely voluntary.

   c. How will you obtain informed consent from each participant or the subject’s legally authorized representative and ensure that all consent forms are appropriately documented? Be sure to attach a copy of your consent form to the project summary.
      i. Consent will be obtained from each subject prior to filling out the survey by completing the Informed Consent Form.

   d. Show that the research plan makes provisions to monitor the data collected to insure the safety of all subjects. This includes the privacy of subjects’ responses and provisions for maintaining the security and confidentiality of the data.
      i. Once the data is collected it will be placed in a sealed envelope and kept in a secure place.

3. Check the appropriate box(es) that describe the subjects you plan to use.

   - Adult volunteers
   - CAL University Students
   - Other Student
   - Prisoners
   - Pregnant Women
   - Physically Handicapped People
   - Mentally Disabled People
   - Economically Disadvantaged People
   - Educationally Disadvantaged People
   - Fetuses or fetal material
   - Children Under 18
   - Neonates
4. Is remuneration involved in your project? □ Yes or ☒ No. If yes, Explain here.

5. Is this project part of a grant? □ Yes or ☒ No If yes, provide the following information:

Title of the Grant Proposal

Name of the Funding Agency

Dates of the Project Period

6. Does your project involve the debriefing of those who participated? □ Yes or ☒ No If Yes, explain the debriefing process here.

7. If your project involves a questionnaire interview, ensure that it meets the requirements of Appendix __ in the Policies and Procedures Manual.

Approved, September 12, 2005
Project Director's Certification
Program Involving HUMAN SUBJECTS

The proposed investigation involves the use of human subjects and I am submitting the complete application form and project description to the Institutional Review Board for Research Involving Human Subjects.

I understand that Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects. If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary or would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board in its effort to provide a continuing review after investigations have been initiated.

I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented:

Professional Research

Project Director's Signature

Student or Class Research

Student Researcher's Signature

Supervising Faculty Member's Signature if required

Department Chairperson's Signature

ACTION OF REVIEW BOARD (IRB use only)

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants;
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

Approved [ ] Disapproved [ ]

Chairperson, Institutional Review Board Date 01/24/07
REFERENCES


Title: SLEEP HABITS OF NCAA DIVISION II ATHLETES AND NON-ATHLETES

Researcher: James J. Pratt

Advisor: Dr. Carol Biddington

Date: May 2007

Research Type: Master’s Thesis

Purpose: The purpose of the study was to examine the sleep habits between athletes and non-athletes at an NCAA Division II institution.

Problem: The question is whether or not sleep habits differed between males vs. females, and athletes vs. non-athletes.

Method: The research design for this study was descriptive. The subjects (N=391) consisted of a convenience sample of athletes and non-athletes from California University of Pennsylvania.

Findings: No significant differences were found for sleep habits between males vs. females, and athletes vs. non-athletes. The football, men’s soccer, and men’s basketball teams showed significantly higher DST scores than the men’s cross country team. Out-of-season athletes had significantly higher DST scores than the in-season athletes.

Conclusion: Athletes do not require different sleep habits than non-athletes do. Similarly, males and females do not require different sleep habits.