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Sleep Self-Study Reflection

For one week during the month of January, I recorded various measures of my waking and sleeping behavior in a diary and with actigraphy. The measures focused on six metrics of sleep health: alertness, satisfaction, efficiency, regularity, duration, and timing (Buysse 2014). Each variable was assessed via comparison to class averages and associations as "good" or "poor" were established. A "good" score in any category increased my overall sleep health score by one point, while a "poor" score did not increase or decrease my sleep health score. In my actigraphy and diary, four of the variables measured were designated "good" while the other two were "poor", resulting in a total sleep health score of 4 out of 6. This sleep health score is relatively good, but there is still room for improvement.

Alertness, Satisfaction, and Regularity

Three metrics that helped increase my sleep health included alertness, satisfaction, and regularity. Alertness is a measure quantified by diary data only. The alertness measure assessed my subjective ability to maintain an attentive state following a night of sleep. For the week, I averaged an alertness rating of 8 out of 10. Compared to my classmates' average score of 6.7, my score was relatively high. Practically speaking, my higher rated alertness and arousal throughout the week suggest that my sleep at night effectively prepared my body for the next day. My score of 8 is considered good, as it was above our class-defined threshold at 7.2, and it helped increase my aggregate sleep health score. The second measure, satisfaction, defines another subjective evaluation of sleep quality. When I felt content with my sleep and believed that it served its purpose effectively, I recorded a higher value for satisfaction. I had a mean satisfaction rating of 8.5 out of 10. This was higher than the class average of 7.37. Based on our class average, scores above 7 were considered good sleep satisfaction scores, so my score was designated as good. The third measure, sleep regularity, describes a measure of the standard deviation or relative spread of sleep timing. In practical terms, sleep regularity is a measure of the consistency of sleep timing. It describes whether or not an individual tends to sleep at the same time of night consistently. Larger values for regularity indicate that an individual's sleep is irregular, and that their sleep mid-point does not tend to fall at the same time every day. Contrastingly, smaller values for regularity represent a smaller spread of sleep mid-points and a more regular sleep pattern. My sleep regularity was 31.12 and 47.79 minutes in my diary and actigraphy data, respectively. Regularity is considered good when it falls under 60 minutes. A majority of my sleep mid-points fell within about 30 to 50 minutes of my average sleep mid-point. Even with my shifted activity later into the night on Saturday, my regularity scores fell under 60 minutes and fell below the class averages of 54.03 minutes from the diary data and 54.78 minutes from the actigraphy data. Therefore, my sleep timing was considered good and helped increase my overall sleep health score.

Duration

One metric, as measured by both diary and actigraphy, did not help increase my aggregate sleep health score: sleep duration. Duration records the total number of hours spent asleep. According to health professionals, 7 to 9 hours is the recommended healthy sleep duration for most individuals. My average duration was 6 hours, 43 minutes in my diary and 6 hours, 10 minutes according to actigraphy. Both of these values are below the 7-hour recommendation. Additionally, both of my durations fell below the corresponding class averages of 7 hours, 41 minutes and 6 hours, 54 minutes from the diary and actigraphy data, respectively. My sleep duration is considered poor by the standards outlined by our class. As a collegiate student-athlete, however, this lower duration was not unexpected. Unfortunately, sleep is not my main priority, and I often lose sleep at the expense of academic, athletic, and social commitments.

Efficiency and Timing

Two metrics, sleep efficiency and timing, varied in their categorization depending on their method of measurement. In other words, these two measures were categorized as "good" in either the diary or actigraphy while being categorized as "poor" in the other. Sleep efficiency measures the percent

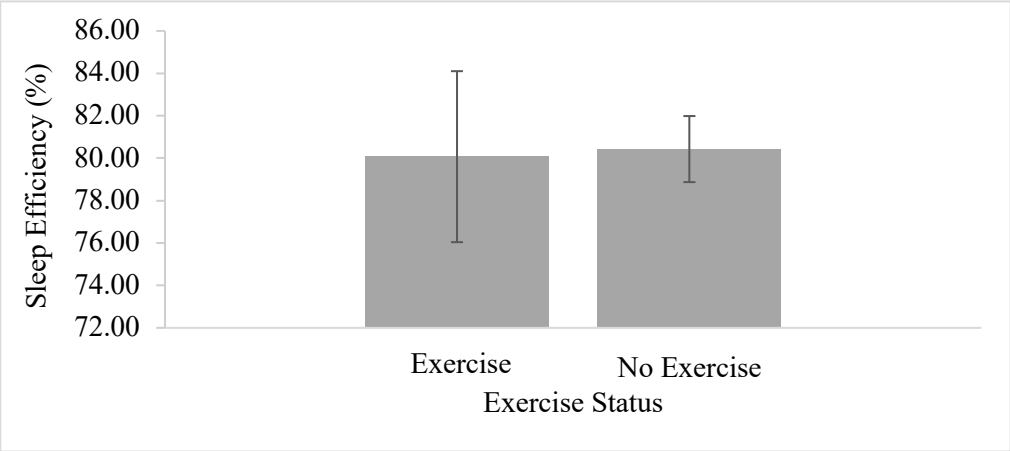
of time spent asleep while in bed. The inability to fall sleep, awakenings during the night, and remaining in bed after awakening in the morning are all events that decrease sleep efficiency. I had an efficiency score of 89.12% and 80.23% from my diary and actigraphy, respectively. This means I spent about 80 to 90 percent of my time in bed sleeping. Looking at my actigraphy data, it appears that I spent at least 15 minutes every day lying in bed after my alarm sounded. Without a doubt, this decreased my efficiency scores. Compared to the class averages of 92.45% and 82.13% from the diary and actigraphy, my values are below average. An efficiency greater than 85% is typically considered good. Therefore, my efficiency as measured by my diary was good, but my efficiency as measured by actigraphy was poor. In a non-dichotomous assessment, I would interpret my efficiency as relatively healthy with room for improvement. Sleep timing, the second variable that differed between actigraphy and diary measures, describes the time of day when someone sleeps. The sleep mid-point, or the time of day that is right in the middle of someone's sleep, is commonly used to evaluate this metric. According to my diary entries, my sleep mid-point fell at 4:11AM. According to my actigraphy data, however, my sleep mid-point fell at 3:54AM. In other words, I tended to be asleep for the same amount of time before and after about 4:00AM on any given night. It's considered good to have a sleep midpoint somewhere between 2AM and 4AM. My mid-point fell just around 4AM, at the edge of the accepted range. Compared to my classmates, who averaged a sleep mid-point of 4:25AM, my sleep mid-point was good.

Analysis of the Effect of Exercise

As a collegiate student-athlete, I am always curious as to how my increased physical activity helps improve my health. The relationship between sleep and exercise has been intensively studied in the past decade, and we have uncovered a mutually beneficial relationship between exercise and sleep. Epidemiological studies consistently demonstrate a positive relationship between improved sleep and increased activity levels (Youngstedt & Kline, 2016). The positive benefits of exercise on sleep have been demonstrated in a wide variety of populations, including young adults like myself (Oudegeest-Sander et al., 2013; Mendelson et al., 2016). In recent years, the relationship between exercise and sleep efficiency, in specific, has come under investigation. Increased physical exertion during daily exercise has been related to increased subjective sleep efficiency ratings (Brand et al., 2014). Likewise, adolescent athletes, who participate in more physically strenuous activities, report higher sleep efficiency on weekend nights compared to their non-athlete peers (Harris et al., 2017). Clearly, a relationship exists between sleep efficiency and exercise. Moreover, this relationship has been tested and confirmed in populations with characteristics that match my own, young adult athletes. Despite all of this evidence, the exact definition of the relationship still remains unclear. Most of the previous research conducted focuses on long-term connections between the variables. There is still contradictory evidence with regard to how one bout of daily activity impacts sleep on the same day. Research using accelerometers showed no association between physical activity levels and sleep duration or efficiency on the same day (Mitchell et al., 2016). The varying evidence prompted my question: How does daytime exercise impact same-night sleep efficiency? In accordance with evidence from Harris et al. (2017), I hypothesize that exercise will significantly increase same-night sleep efficiency.

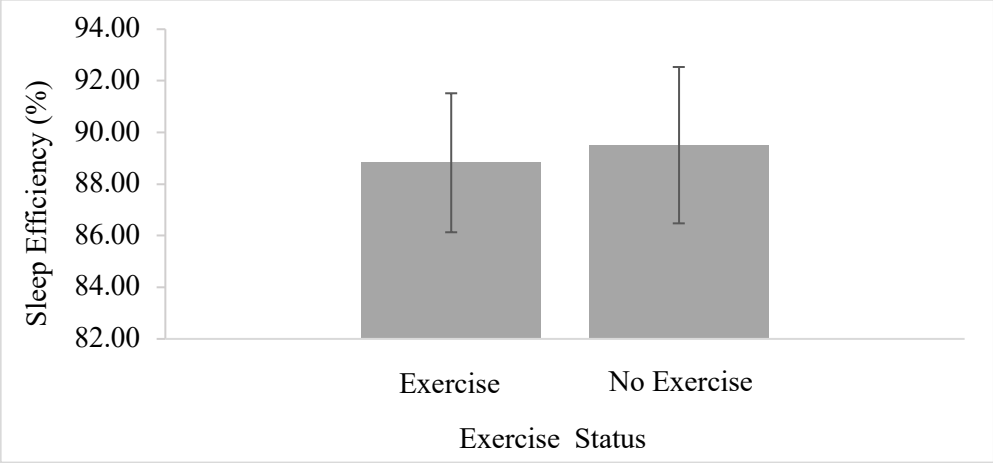
To conduct my analysis, I separated my data into two categories: exercise and no exercise. On three days, I did not exercise. On the remaining four days, I exercised for anywhere from one to three hours. I compared the sleep efficiencies in these two categories using an ANOVA. Results demonstrated no significant difference in sleep efficiency between the exercise and no exercise days from the diary ($F = 0.100$, $p = 0.765$, $d = 0.119$) and actigraphy ($F = 0.020$, $p = 0.892$, $d = 0.237$) (See Figures 1 and 2).

Figure One: Mean Sleep Efficiency from Actigraphy After Exercise and After No Exercise



Note. Error bars represent standard deviations.

Figure Two: Mean Sleep Efficiency from Diary After Exercise and After No Exercise



Note. Error bars represent standard deviations.

The data analysis does not support my hypothesis and does not match most of the research on the long-term relationship between exercise and sleep efficiency. There was a small and insignificant effect of exercise on sleep efficiency, as shown by effect sizes around 0.2 and p-values greater than 0.05. In fact, the days without exercise show slight increases in sleep efficiency, an effect opposite of my prediction. My results do, however, match the findings of Mitchell et al. (2016), who conducted similar short-term research analyzing the relationship between sleep and same-day activity. My data and the data from Mitchell et al. (2016) suggest that exercise does not serve as a short-term mediator of sleep efficiency. Meaning that exercise may not spark an immediate, same-day improvement in sleep efficiency, as originally hypothesized. Exercising regularly over the course of a few weeks or months, however, may improve generalized sleep efficiency, as seen in other previous studies performed by Brand et al. (2014) and Harris et al. (2017).

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Personal Reflection

As a society, we rarely prioritize our sleep. The constant pressure to excel in our personal, social, and professional lives puts sleep at the end of our to-do lists. By analyzing my sleep for only a week, I was able to see first-hand how I handle sleep in my own life, and what I discovered was fascinating.

One main takeaway from my self-study was the impact of social jet lag. My conclusion: social jet lag is real and prevalent among the young adult population. When the class first discussed social jet lag, I brushed it off, considering the behavior inevitable for students my age. Nonetheless, after this study, the severity of the behavior has become more apparent in my own lifestyle and the lifestyles of my friends and family. My older brother, who recently graduated from college, works a full-time consulting job during the week, yet he stays up extremely late on the weekends. The radical shift from his Saturday to Sunday night schedule shocked me at first. I never realized how sporadic his sleep schedule was until I started to see the same tendencies in my own behavior. On Saturday evening during the study, my sleep mid-point fell at 5:25AM. This mid-point was far later than all the others and falls later than the body's natural nocturnal body temperature dip. As a result, my sleep was farther out of circadian phase, and my sleep quality was likely reduced. The difference was due to the fact that I stayed out late with my friends. I'd like to improve this behavior, but it's difficult to gauge if my goal is realistic. The social pressure and custom of late-night weekend outings is ingrained in college culture, and the so-called "fear of missing out" feels real, despite the fact I wish I could ignore it. The major hurdle of ignoring this social pressure could likely prevent improvement in this behavior until after I graduate from college. Realistically, I don't anticipate any major changes in my behavior. Although, now that I am more conscious of social jet lag, I may prioritize returning home slightly earlier on weekends so that the lag isn't as sizeable.

After receiving my actigraphy report, one element immediately stood out to me. I spend a large proportion of mornings and evenings lying in bed awake. My mornings typically involve my alarm ringing 20 to 30 minutes before I physically rise out of bed. Although my demeanor is pleasant after awakening, the process of waking up triggers an innate feeling of resistance and reluctance in my mind that is apparent in my actigraphy report. Given the opportunity, I would like to improve this aspect of my sleep. As of now, I tend to wake up far too close to the beginning of my day, giving myself little time to gather my belongings and prepare. With regards to sleep analysis, correcting this behavior would result in a major improvement in my sleep efficiency. Despite all of my best intentions thus far, I have failed to change my behavior. The main barrier that blocks improvement is an inherent quality of any college student's or working adult's schedule: an early morning start time. As a college athlete, my afternoon practices and games necessitate scheduling earlier classes. For the past two semesters, for example, I started my classes at 8AM at least three days per week. Despite this earlier start time, I did not necessarily go to bed any earlier than if I were to have class at 10AM. The inability to awaken in the morning, therefore, may be rooted in the mild state of sleep deprivation to which I have subjected myself.

By and large, I found that this study helped me start to pay attention to aspects of daytime and nighttime behavior that usually go unnoticed. For instance, I started to mentally record my food intake before bed, and I quickly realized that I eat food far too often as a part of my nightly routine. Research has shown that nighttime snacking has negative impacts of sleep quality, as it interferes with normal metabolic processes (Crispim et al. 2011). The simple recognition of this unwanted behavior is an important step in behavioral change. Given the time, I think that if alter my eating at dinner time, I can reduce my hunger before bed and slowly stop this behavior.

Overall, my participation in the sleep study was a beneficial experience. I have identified a few undesirable behaviors, and I have plans to initiate change and continue actively monitoring my sleep behavior. Hopefully, this study and this class with help improve my sleep health long-term.

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