How do you sleep at night?: A survey study on sleep deprivation and cognition

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Abstract

Background: Sacrificing sleep on a daily basis has become a lifestyle for a growing number of people. This habit has been found to decrease overall cognitive health and performance. Raising awareness about benefits of a good night's sleep and the negative effects of inadequate sleep is pertinent to shaping a healthy public conscience about sleep. It is also an important factor to consider for public health professionals since they must think critically throughout the working day and their work impacts those in their care. The purpose of this study was to assess the association between cognitive performance and sleep-related habits in a population of 31 Environmental Health students at BCIT during the Winter 2014 semester.

Methods: A survey that collected subjective data on sleep-related habits and a brief cognitive test were used to assess cognitive performance. The cognitive test scores were marked with an index out of 20 and analyzed with a paired T-test to explore any differences from two study trials in January and February.

Results: There was a significant decrease in cognitive index scores over the four week period. This was confirmed by a paired T-test with a p-value of 0.000005, with a significance level of $\alpha = 0.05$. Average index scores were 18.91993 in January, 15.87063 in February, and the rounded average decline in scores was 3.13.

Conclusion: Using an electronic device prior to going to sleep was deemed to be the most likely factor behind a significant decline in cognitive performance between January and February. Excessive exposure to light during naturally dark hours of the evening may curtail physiological processes during sleep (i.e. hormonal activities) effecting cognitive health and performance.

Key Words: Sleep, cognition, sleep deprivation, mental health, healthy sleep

Introduction

Sleep has become something that most people in North America need but cannot spare time for. Over a span of less than one generation, people adopted a culture that interferes with natural sleeping patterns. This "24/7 culture" has limited pay off in comparison to its costs (Pickering & DPhil, 2006). Inadequate and poorly timed sleep is strongly associated with adverse health effects. Feelings of tiredness and a deficit in attentiveness and cognition during the day are well known attributes to a lack of sleep. Lethargy may become frequent and perceived as 'normal', however cognitive and physiological functioning are affected negatively (Sigurdson & Ayas, 2007). Timing and duration of sleep determine how well the body is able to carry out restorative processes that occur during sleep (Dean, et al., 2012). Hormonal events that take place within the brain during sleep govern the mental condition of an individual (Caldwell, 2003). Poor sleeping habits have a mal-effect on cognitive health and performance. Memory, temperament and problem solving are important factors affected by sleep and have downstream effects on decision-making and task performance.

Hindered psychological states and sleep deprivation go hand in hand in the results of many studies. Concern for the effects of sleep deprivation on cognitive performance belong to the professional realm. Lombardi's survey review on work related injuries reveals that incidences of injury increase during working hours if workers are sleep deprived (2010). Professionals with important decision-making tasks experience a decline in performance after being sleep deprived for 24 hours according to an article by Horne (2013). Opportunistic benefits of staying awake excessively are not worth their costs.

One of the busiest groups at the heart of "24/7 culture" is post-secondary students. Long periods of sleep deprivation can cause the body to eventually adapt and grow accustomed (Schneyer, Zeithamova, & Williams, 2009). Despite physiological adaptation of the rest of the body, cognition is still affected detrimentally. Using a survey and short cognition test, first and second year students of the Environmental Health Program at the British Columbia Institute of Technology (BCIT) were studied at two different points in time during the Winter 2014 semester. Survey times were separated by four weeks. Self-reported sleeping habits were used as scaled indicators for sleep deprivation and the cognition test was graded on an index as a direct measurement of cognitive performance. Analyzing the differences over time in cognitive index scores from the same population enabled the effects of sleep deprivation to be assessed. If there was a decline in cognitive performance over the four week period within the Winter 2014 semester, it was expected that healthy self-reported sleeping habits would also be reported in survey results. Tracking the sleeping habits of students as their schedule gets busier should provide a good illustration of the effects of sleep deprivation.

Literature Review

The daily demands of North American society require people to extend their waking hours beyond the natural sleeping times for humans. The 24 hour day is segmented by cycles of daylight and nightfall. Long-standing theories agree with an article about the sleep-wake cycle by Maire, Reichert and Schmidt (2013). There is strong evidence suggesting ideal timing for sleep revolves around internal circadian and homeostatic cycles (Maire, Reichert, & Schmidt, 2013). The circadian cycle is based on the "biological day" – the rising and setting of the sun; the homeostatic cycle depends on a person's recent sleeping habits (Maire, Reichert, & Schmidt, 2013). A discussion on sleep deprivation, by Orzel-Gryglewska explains modern society and behavioral choices intervene with natural rhythms for sleep causing sleep deprivation (2010). Three critical points of sleep deprivation are the timing of sleep, the duration of sleep and the quality of sleep.

The Timing of Sleep

In Maire, Reichert and Schmidt's article, it is argued that the ideal time for adults to be awake is the 16-hour light period between 8:00am and midnight, and sleeping is best done in the dark 8 hours between midnight and 8:00am (2013). This externally based pattern of sleep is commonly referred to as the "circadian day" or "biological day" by many studies. A discussion of poor sleep resulting in pro-inflammatory responses by Rohleder, Aringer and Boentert explains how an ideal diurnal-based sleep schedule allows hormonal and neuronal activities to occur rhythmically with the circadian and homeostatic cycles (2012). Hormones whose activity depend on the timing of sleep govern cognitive ability and tiredness throughout the day. The light-exposure regulated hormone melatonin comes from the pineal gland in the brain and primes the body for sleep (Maire, Reichert, & Schmidt, 2013). The action of melatonin depends on *when* sleep occurs, not for how long. Research by Cajochen et al. showed that exposure to light from laptops between 11:00PM and 3:00AM delayed melatonin production (Cajochen, et al., 2011). Light exposure at normally dark hours inhibits melatonin and by doing so prevents sleep from occurring.

The Duration of Sleep

Gradner et al's findings in their review that links sleep duration to cardiovascular disease related mortality showed that if the ideal duration of 8 hours of sleep is not met, physiological pathways are negatively affected (2013). Good sleep is dependent on an internal factor commonly referred to as the "homeostatic cycle" which depends on how long an individual has been awake (Maire, Reichert, & Schmidt, 2013). Stress hormones such as cortisol are regulated by the duration of sleep an individual has budgeted in their day. While cortisol is essential to function during the day, its levels must be brought down during sleep so that the body has a chance to rest – this includes the brain (Grandner, Sands-Lincoln, Pak, & Garland, 2013). Anafi et al.'s review on molecular events involving tissue repair during sleep compared the condition of neural tissues of mice with and without deprivation. Anafi et al. found poorer tissue conditions in mice with less than 6 hours of sleep (2013). Homeostatic events that maintain the healthy state of the brain cannot occur during periods of being awake because of the high level of activity (Anafi, et al., 2013). Maire, Reichert and Schmidt state that over the course of the day a homeostatic "debt" builds and peaks in the evening after the majority of the day has passed (2013). If the duration of sleep is not ideal the sleep deficit carries over into the next day, leaving the cognitive capability shorter than ideal for the day than it should be (Maire, Reichert, & Schmidt, 2013).

The Quality of Sleep

Good quality sleep is achieved by alternating between non-Rapid-Eye-Movement sleep (non-REM) and Rapid-Eye-Movement sleep (REM) (De Gennaro, et al., 2002). There are four sequentially slower stages of brain activity patterns in non-REM sleep, where the last two are the most "restorative" for cognition, followed by REM sleep – when dreams occur (Caldwell, 2003). Since dreams occur during REM sleep and REM sleep follows the most beneficial part of sleep, then dreams can be an indicator of good sleep quality. Waking in the middle of the night is an indicator of poor sleep quality since less time is spent in stages of restorative activity. Sallinen, et al. explored the relationship between sleep loss and cognitive performance in problem solving in young males age 19 to 22 years old (2008). By observing brain activity, they determined dampened cognitive performance consistently correlated to an absence of third and fourth states of non-REM sleep (Sallinen, et al., 2008).

Having a schedule perfectly in harmony with circadian and homeostatic cycles is does not fit societal demands according to Schenyer, Zeithamova and Williams in their research on sleep deprivation effects on cognition (2009). These demands are placed on the individual who ultimately makes the choice to shorten their sleep time. Sleep deprivation in a "24/7 society" has cultural significance in terms of status – Pickering and Phil mention that being sleep deprived means being successful and hardworking because it implies a lucrative workload (2013). Findings are consistent in showing that shortening sleep duration has an overall negative effect on cognitive performance. In concert with sleep timing, duration and quality, there are hormones and messenger molecules that regulate throughout the day.

The physiological experience of intense fatigue during waking hours hinders the ability to perform a task. There are many messenger molecules with circadian-based fluctuations that govern levels of drowsiness through the Central Nervous System (CNS) and Sympathetic Nervous System (SNS) (Grandner, Sands-Lincoln, Pak, & Garland, 2013). Furthermore, cardiovascular tissues have protein and DNA correction processes to keep the cardiopulmonary system functioning at its best during the hours of conscious activity (Anafi, et al., 2013). Prolonged wakefulness means that the body is excited, not resting, and this minimizes the time for tissues to repair and vital organs to rest, further inhibiting neuronal recuperation by keeping the body in an excited state.

Orzel-Gryglewska recognizes that maintaining cognitive function is crucial to many occupations and which is something sleep does by maintaining brain tissue and memory (2010). Regular 6 hours of sleep per night is enough to botch cognitive performance (Orzel-Gryglewska, 2010). This affirms the ideal duration of 7-8 hours for sleep (Maire, Reichert, & Schmidt, 2013). Genetic variability among people should be taken into consideration in terms of how much sleep an individual may need (Meerlo, Koehl, Van der Borght, & Turek, 2002). Acknowledging individuality is important when exploring how sleep affects neurological health and cognitive performance, especially when considering professional environments.

Work Place Safety

One study likened the effects of 24 hours of sleep deprivation on psycho-motor control to a blood alcohol level (BAL) of 0.10% (Sigurdson & Ayas, 2007). This effect demands serious considerations for work place safety. Jobs that require the operation of a potentially dangerous equipment or vehicles, and critical thinking and decision making are of particular concern. There is very little protection built into legislation that ensures these professions are getting enough sleep to perform at their best mental ability. Motor-vehicle accidents attributed to drowsy-driving occur as often as 100,000 times a year in America (Breus, 2006). Drivers who are sleepy tend to increase their speed in an attempt to keep themselves awake increasing the risk of an accident (Mulgrew, et al., 2008). In light of hazards like this the Motor Vehicle Act in BC mandates truck drivers to have a designated 8 hour resting period during long drives (BC Motor Vehicle Act, 2013). In Sigurdson and Ayas' study the effect of a disarrayed sleep schedule due to the 12 hour per day shift work of nurses was explored. The 12 hour working shift resulted in hindered decision making and a botched performance affecting the well-being of patients (Sigurdson & Ayas, 2007). Having "on-job" restorative naps, albeit inadequate naps, for such strenuous labor is culturally accepted in North America. Having "on-job" naps for professions that may not be physically tolling but require optimal cognitive performance ultimately affecting the public, is far from acceptable even though a simple restful pause would help with otherwise impaired cognitive performance (Sallinen, et al., 2008). "Off-job" sleep at home is more acceptable and sensible solution as Sallinen's study concludes (2008).

Critical Thinking

Critical thinking is very important to the field of public health care, lacking sleep interferes with the ability to assess a situation (Schneyer, Zeithamova, & Williams, 2009). Changes in the hormonal pathways from sleep deprivation leads to troubles with "integrated decision making" and impaired verbal response time from inefficient brain activity (Schneyer, Zeithamova, & Williams, 2009). The upkeep of brain tissue is regulated by the Hypothalamic-Adrenal-Pituitary (HAP) gland axis in the brain (Meerlo, Koehl, Van der Borght, & Turek, 2002). Glucocorticoids are hormones from the HAP gland axis that promote the breakdown of stored sugars and protein to provide energy for extended wakefulness and play a role in memory (Hipolide, et al., 2006). Overactive glucocorticoid pathways and continuous sleep deprivation leads to a desensitized activation of this pathway and a cognitive hurdle to learn new things (Meerlo, Koehl, Van der Borght, & Turek, 2002). A study by Dixit, Thalwani, Goyal and Vaney on psychomotor skills suggests a lack of sleep increases response time and introduces errors to "monotonous tasks" (2012). Record keeping and filling out inspection reports and other legal documents require utmost precision and are at high risk of error being introduced to them in the hands of a sleep deprived Environmental Health Officer (EHO), for instance. A study by Pilcher and Walters compared cognition in one group with 24 hours of sleep deprivation to another with 8 hours of sleep (1997). This showed that the sleep deprived group exerted more effort to perform a cognitive task and subjectively overestimated their performance (Pilcher & Walters, 1997). Having false confidence in decision making is another factor that could discredit a public health care worker.

Interpersonal Interactions

A sleep deprived brain tends to have difficulty with sensitive interpersonal communication skills. It is common knowledge that sleep is often accompanied by a lack of patience and plenty of irritability (Gordon, 2013). Having adequate sleep leaves the brain with higher levels of dopamine, which increases subjective levels of happiness (Wiley & Formby, 2000). It can also change an individual's ability to analyze risks and make sound decisions (Horne, 2013). Public health care is built around working with people and critical thinking. Communicating well with people requires a clear mind. A lack of sleep will increase the activity of hormones that are usually active in an excited state of panic and stress the body (Wiley & Formby, 2000). Having a physically stressed body and a tired mind on a regular basis can lead to depression. Various mental illnesses have sleep deprivation as a common symptom of cognitive malfunction (Wiley & Formby, 2000). At the heart of these cognitive malfunctions is the deregulation of serotonin. Normally serotonin is able to get taken up by neurons in the brain and work with Brain-Derived-Neurotrophic-Factor (BDNF) to facilitate learning and memory. Serotonin should be converted to melatonin during sleep, however shortened sleep results in overwhelming levels of serotonin disrupting the interaction with BDNF (Wiley & Formby, 2000). Depressing the ability to learn and remember compromises the quality of interpersonal interactions and overall performance.

Having naps and ingesting caffeine in order to self-control the need for sleep does not improve the overall cognitive ability of a sleep deprived individual (2013). Pejovic et al., has reported similar findings for a short lived improvement in overall cognitive performance from napping, but no full return to the pre-sleep-deprived state for the body (2010). Sleeping more to 'catch up' on sleep is most often done on weekends (Oginska & Pokorski, 2006). This is effective if there is only one day of sleep deprivation to recover from, but if it is to compensate for chronic sleep deprivation, it will not have the desired effect. Two days is not enough to make up for five days-worth of sleep deprivation (Orzel-Gryglewska, 2010). The greater the pre-existing lack of sleep, the longer the duration of sleep is required to recover (Sallinen, et al., 2008). Adequate sleep can have a multifaceted positive effect on health and a negative and damaging effect when it is insufficient. Getting *enough* good sleep is a critical part of health that is under-rated.

Methods

All participants filled out a survey and completed a cognitive test for both the January and February sessions. For the first survey session all participants read and signed the consent form. There were no known harmful side effects to participating in the survey study. Confidentiality and discretion were used by the researcher during the study. Participants completed the survey at their own pace. After, the researcher briefly explained the cognitive test for each session. Each exercise was explained to participants prior to participants attempting them.

The Survey

Subjective data was collected using the same survey at two times separated by four weeks. The researcher designed the survey with questions ordered to guide the participant through the course of a day. The questions in the survey were designed to analyze and compare the following aspects of sleep deprivation in the student population between a less busy and busy time in their Winter 2014 semester (Table 1).

Table 1: An outline of survey questions

Question	Information Gathered
Demographic Data *Questions 1 to 3*	The age, sex and program year of participants was gathered in to clearly describe the study population.
Timing and Duration of Sleep *Questions 4, 10, 12*	The timing of sleep (i.e.: waking time and sleeping time) was compared between early and later in the semester to assess the difference ideal circadian-baseline for waking (i.e. 8:00am) and sleeping (i.e. 12:00am).
Quality of Sleep *Questions 14 to 16*	Frequency of dreams, exposure to artificial light in the evening, and experiences of waking in the middle of the night were indicators for whether individuals were getting the rest their body needs during sleep for cognitive restorative processes to occur.
Homeostatic Pressure *Questions 5, 9, 11, 13, 17*	Troubles going to sleep, falling asleep at undesirable times throughout the day, finding it difficult to get out of bed and using weekends to compensate for sleep loss were all used to indicate a sleep debt.
Changes in Diet *Questions 6 to 8*	Questions regarding diet served as markers for the changes in healthy choices, however this data was disregarded because of ambiguity.

The Cognitive Test

Short term memory exercises and arithmetic questions were completed without the assistance of a calculator. The cognitive test was coupled with a Power Point slideshow developed by the researcher. This basic test was based off similar ones described in Schneyer et al.'s study (2009). Test results were evaluated by an index out of 20 using corresponding marking schemes for each version of the test. Both versions of the cognitive test consisted of similar exercises and were designed to be equal in difficulty. Simple pattern recognition, word and picture memorization and arithmetic were used in the design of the cognitive test questions.

Statistical Analyses

Microsoft Office Excel was used to record the raw nominal and ordinal data from the surveys. Nominal data was sorted into three broad categories to compare the data sets between the two points in the semester: Timing of Sleep, Duration of Sleep and Quality of Sleep. The differences in cognitive test scores was analyzed using a paired T-test.

Results

Cognitive Performance

The rounded average score was 18.92 in January and 15.87 in February (NCSS: Statistical & Power Analysis Software, 2013). The rounded average difference in scores between January and February was 3.13 in favor of January scores, and the mean and mode in rounded average difference were 3 (Table 2).

Table 2: Descriptive Statistics for Cognitive Test Index Score Differences Between January and February

Mean	3.12903	Minimum	-2
Median	3	Maximum	8
Mode	3	Count	31
Standard Deviation	2.667607	Largest (1)	8
Sample Variance	7.116129	Smallest (1)	-2
Range	10	Confidence Level (95.0%)	0.978486

Statistical Analysis of Index Scores

The null hypothesis predicted the cognitive performance index scores from January and February will not change significantly. The experimental hypothesis predicted the cognitive performance index scores from January will be significantly different from the cognitive performance index scores from February.

An inferential analysis using one-tailed paired t-Test was run on the cognitive test scores between January and February using NCSS 9. Average index scores were 18.91993 in January, and 15.87063 in February. On average, test scores were higher by an average of 3.129032 in January. Tests of assumption showed the data was normally distributed, therefore results from parametric paired sample t-test were read. P=0.0000 therefore we can reject H_o and conclude there was a statistically significant difference in cognitive test index scores between January and February. The parametric test results for the paired t-test read p=0.00000 therefore no alpha or beta error. Power of the results were 100% when $\alpha = 0.01$, and 100% when $\alpha = 0.05$, suggesting the sample size was adequate for this study, and no type I or type II error.

Timing of Sleep

Eight subjects reported a change in sleep schedule in the February survey. There were no major differences between the two months. In February, those who woke up between 5:00AM and 6:00AM had the greatest decrease (of four points) in cognitive test scores (Figures 1 and 2).

Figure 1: Differences in Cognitive Test Index Scores vs. Wake Up Times in February (x_2-x_1 = [Feb. Score]-[Jan. Score])

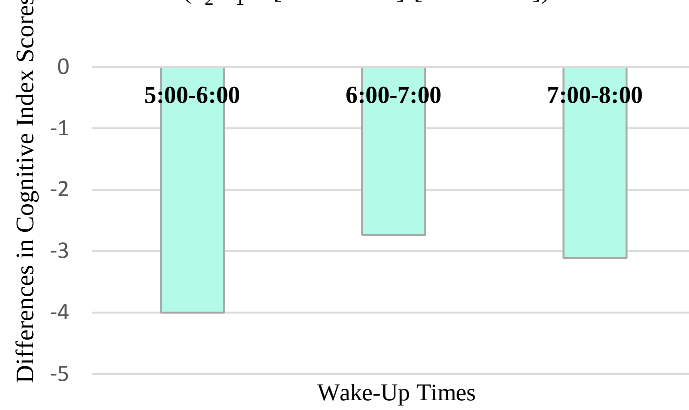
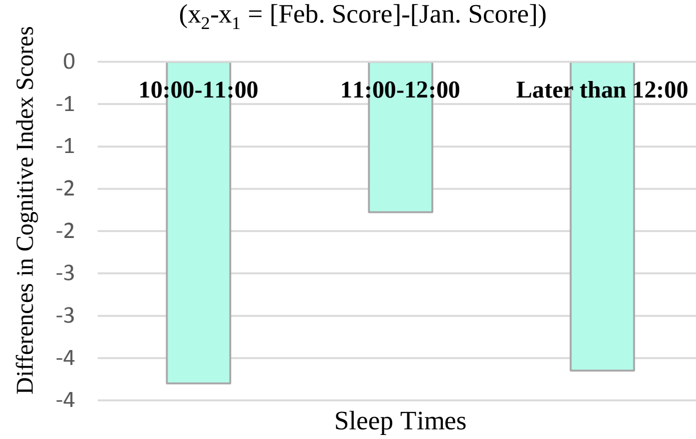


Figure 2: Rounded Averages of Cognitive Test Index Scores vs. Sleep Times in February (x_2-x_1 = [Feb. Score]-[Jan. Score])

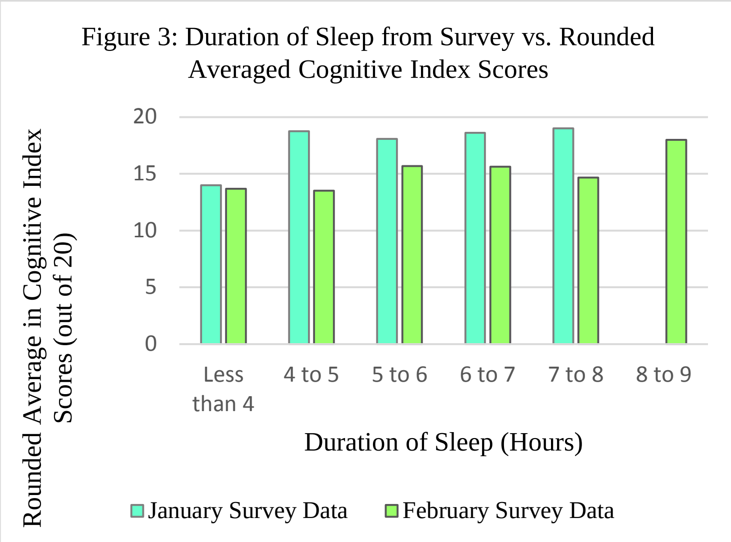


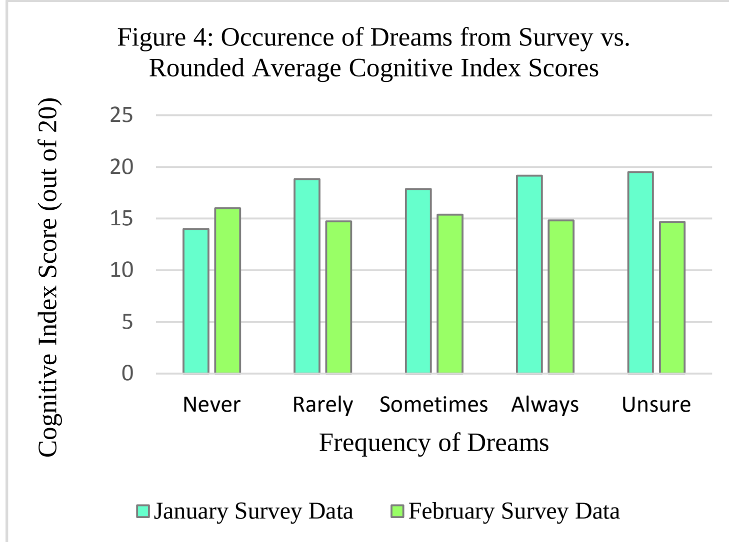
Duration of Sleep

Highest cognitive test scores belonged to participants getting 4 to 5, 6 to 7, and 7 to 8 hours of sleep in January. For February, the highest scores belonged to subjects getting 8 to 9 hours of sleep per night. Six subjects reported having less sleep in February than January (Figure 3).

Quality of Sleep

Subjects who reported that they had dreams in January tended to get higher cognitive index scores and this pattern plateaued in February – regardless of dream frequency in February, cognitive scores declined overall (Figure 4).





Discussion

Unlike most studies on sleep deprivation this study did not control the amount of sleep participants were getting. Allowing the course of a busy semester to alter the sleep behavior choices of participants provided a window into a real life setting where sleep deprivation takes its toll. The objective of most sleep studies is to isolate a specific parameter of sleep by measuring levels of different of hormones associated with cognition and brain activity. This study does not isolate the toll of sleep to assess its impact on cognition. Sleep deprivation and all of its accompanying habits and factors are observed. A more effective study that could branch from this study could revolve around interpersonal communication or more field-related scenario questions. This would allow the effect of sleep deprivation on relevant cognitive activity to be evaluated. This study is limited by its reliance on subjective, self-reported data, yet it is unique to have participants who are able to make the choice to deprive themselves of sleep or not under the circumstances of an increasingly busy schedule and demands from school. There was a decrease in cognitive performance between the two months which can easily be explained by the demands placed on participants' schedules, since they are students.

According to Caldwell individuals may be able to adapt to a "24/7 society" schedule, but an additive stress is placed on the body and mind (2003). The same principle applies to the duration of sleep (Caldwell, 2003). For the students in this study, the overall timing for wake-up revolved around a school day that would typically begin at 8:30AM. Over the four week period only a few participants reported earilier wake up times in February. Sleep-time was already later than 12:00AM according to the January survey and it either stayed the same or got later in February (except for 3 cases who reported going to bed earlier). Both times already fell out of the bounds of ideal circadian timing, being 8:00AM for wake up and 12:00AM for sleep (Maire, Reichert, & Schmidt, 2013). Interestingly, the timing of sleep in February did not agree with the idea that an earlier bedtime would be better for cognitive performance. On the contrary, in Figure 2, it can be seen that a later bed time declined by the same number of points as the earlier bedtime. The timing of events is out of the hands of students but they do have control over when they go to sleep and therefore how much sleep they get.

Lombardi, Folkard, Willetts, and Smith's study on sleep and work-related injury showed that self-reported sleep was significantly greater than the actual amount obtained (2010). The current study did not find any discrepancies between self-reported timing and duration, however both could have been skewed due to self-reporting. The amounts of sleep that participants were getting were overall steady with the majority getting between 5 to 6 hours per night in January and February. From timing and duration, it could be noted that in February, people who were getting more sleep did better in terms of cognitive test scores.

Regardless of timing and duration, the quality of sleep determines how well the brain is able to undergo restorative processes during sleep. In order to have dreams, brain activity must go though a sequence of restorative stages of deep sleep, making dreams an indication of sleep quality (Wiley & Formby, 2000). For January, people having dreams tended to perform better on the cognitive test, and then in February, this trend flat-lined (Figure 4). A closer look at practices surrounding bedtime for many students may shed more light on why cognitive performance may have declined.

Melatonin is a sleep inducing hormone whose production is triggered by an absence of light. Constant accessibility to laptops and smartphones and other electronic devices present an opportunity to maximize productivity. As handy as they may be, they all emit light at unnatural times of the day. A study by Cajochen et al showed lower melatonin levels were present in the serum of individuals who used their light emitting devices prior to sleep (2011). This is when the body should be in the dark producing melatonin to prime itself for sleep (Cajochen, et al., 2011). Most students in the study reported using an electronic device before sleeping. With an increasingly busier schedule there is more reason to be using an electronic device for longer throughout the day, and into the night. Being exposed to these sources of light would delay the production of melatonin, and prevent individuals from reaching restorative sleep. Rather than having dreams the brain would remain at half-conscious state stuck in the earlier stages of sleep rather than dreams (Caldwell, 2003). The effect of melatonin is reflected in this study since those who spent less time on their electronic devices in February had better average cognition index scores.

Survey data from February showed subtle trends. Higher cognitive index averages were reflected in participants reporting better moods and more attentiveness at school. Temperament and attentiveness are affected by sleep and play important key factors in interpersonal relations (Gordon, 2013). It would be valuable to research more into the effects of sleep deprivation on interpersonal relationships. Making sure that professionals in public health care are able to think clearly and communicate well is an important avenue to explore.

There are long term effects of prolonged sleep deprivation that wear out cardiovascular and nervous systems. The acute effects are also of concern because of the damaging effect they have on the individual and those around them. Sigurdson and Ayas's article on public health and sleep disorders details the importance of ensuring optimal cognitive ability in medical settings for safety of patients and care givers (2007). However all positions involving critical thinking and problem solving can benefit from good sleeping habits. Regardless of youth and adaptability that comes with a student lifestyle – students in this study did show a significant decline in cognitive performance. One can only wonder how their sleeping habits could affect the efficacy of their study habits and academic perfomance. A sleep deprived lifestyle is not something worth getting used to in order to achieve all that one is capable of.

Recommendations

One recommendation from these findings would be that less time spent on electronic devices prior to sleep would benefit cognitive health and performance. The findings from this study can help promote student in terms of sleep habits. Perhaps if students are made aware of the dramatic decrease in cognitive performance as a result of increased light exposure prior to sleep, they would govern themselves differently, improving their overall performance.

Limitations of Study

Subjective Data

The survey done for the purpose this study is heavily weighted on subjective data which leaves room for dishonesty and inaccuracy. Many sleep-based studies measure these items objectively in sleeping labs by written records by using EEG readings of brain activity for the occurrence of dreams/REM stages of sleep. Due to constraints of gaining the facilities to conduct such research, let alone resources and proper training, this objective data collection was not possible.

Study Population and Survey Frequency

The participant population is limited in terms of size. During the Winter 2014 semester, there were approximately 60 students in total enrolled in Environmental Health. Ideally, this survey would have the participation of the entire population. Also, it would have been beneficial to the study to be able to conduct more survey sessions, but coordinating student participants proved to be cumbersome while being considerate of their increasingly busy schedules.

Future Studies

Future studies could explore the relationship between technology use and sleep in populations that are based on occupation or lifestyle commonalities. This would involve comparing sleeping habits in terms of electronic device use and cognitive performance. Using this information in specific populations of particular professions and workplaces may help raise awareness about the importance of sleep, and lead to healthier behaviors for sleep.

Conclusion

Survey results from January compared to results in February revealed little change in overall sleeping habits within the student population from Environmental Health at BCIT. The survey in January already showed poor sleeping habits in practice in the participant population. Over the four week period between January and February the cognitive scores declined significantly. Given the poor state of sleeping habits and clear decline in cognitive performance, an additive effect of poor sleeping habits on cognition in the student population. Knowing the semester became more time demanding on students, it is understandable that more time would be spend on electronic devices. Time spent on these devices prior to sleep increased according to the survey data, possibly explaining the decline in cognitive index scores overall. Raising awareness of the importance of getting good sleep for the sake of optimal cognitive performance in the field of health care where critical thinking is required is an inexpensive and effective way to improve the delivery wide variety of public health positions. Cognitive health is the root of well-being, and should not be underestimated or unaddressed by the field of public health.

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Competing Interests

The author declares that they have no competing interests

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