TEACH[R]

Struggling to stay awake: The sleep patterns of Adventist secondary school students

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Abstract

Sleep deprivation studies indicate that sleep is vital to emotional, physical and behavioural wellbeing. This study presents the results of a survey in which 945 students in Seventh-day Adventist secondary schools responded to questions about the length and quality of their sleep. The study found that: almost one half of the students were at risk of falling short of the recommended number of hours of sleep per night; toward one in every five students were averaging six or fewer hours sleep per night; the quality of sleep (in terms of better sleep habits) and the resulting levels of daytime alertness were clearly linked to having a permanent, personal space for sleep; and finally that academic performance was strongly related to measures of daytime alertness and measures of the quality of sleep habits.

> *"The nature of modern life, particularly the growing use of screens for work, communications and entertainment, has deprived most people ... a healthy night's sleep"*

Introduction

Sleep is such a common behaviour that it is often treated with disdain. Never-the-less sleep is of great importance. This article discusses the nature of sleep, reviews the literature on sleep deprivation and examines the importance of sleep to learning. The article presents the findings of a survey exploring the sleep habits of adolescents enrolled in Seventh-day Adventist secondary schools across Australia and examines the students' perceptions of their own sleep habits.

The nature of sleep

Sleep is a reversible state of altered consciousness in which the body is often prone, the eyes closed, and in the words of Caskadon and Derment (2011, p. 16) there is "perceptual disengagement from, and unresponsiveness to the environment". Despite this, the brain remains surprisingly active during sleep and this activity allows electroencephalograms (EEGs) to be produced (Winston, 2003).

For human beings, as with most other mammals, sleep follows a regular rhythmic daily pattern known as the circadian rhythm (Caskadon & Derment, 2011). Generally, humans are awake and alert during the daylight hours and sleep at night. Most adults sleep for approximately one quarter to one third of a 24 hour period. Children and young teenagers sleep for longer periods than adults. However, the nature of modern life, particularly the growing use of screens for work, communications and entertainment, has deprived most people in the developed world, children to adults, of what would be considered to be a healthy night's sleep (Olds, Ridley, & Dollman, 2006; Van den Bulck, 2004).

Within periods of sleep there is yet another pattern. Sleep cycles between periods of deep sleep followed by periods of lighter sleep (Caskadon & Derment, 2011). REM is the acronym for 'rapid eye-movement'. In deep sleep the eyes are still and hence it is also known as non-REM sleep (NREM sleep). On the other hand light sleep is characterised by rapid eye movement and it is known as REM sleep. REM sleep involves rapid, busy brain activity that gives rise to high frequency, low amplitude waves that appear

on an EEG like jagged bad handwriting (Winston, 2003).

On falling asleep following a normal period of wakefulness, human beings quickly progress into an initial period of NREM sleep that is likely to extend upward to an hour and half (Caskadon & Derment, 2011). This is followed by a short period of REM sleep during which dreaming often occurs. During the course of a night's sleep an individual may progress through a number of NREM and REM sleep cycles in which each cycle becomes progressively shorter.

Sleep-wake circuits in the brain

There are two distinct but interactive neuronal (brain) circuits that respectively control the alert state of wakefulness and the quiescent state of sleep (Schwartz & Roth, 2008). These two circuits form an 'on-off switch' in that activation of one circuit substantially dampens the activity of the other (Saper, Chou & Scammell, 2001). The positioning of the 'on-off switch' is broadly controlled by a 'master clock' that is sensitive to the changing patterns of light and dark in each day (Saper, Cano & Scammell, 2005). Both neuronal circuits involve differing arrays of chemical messengers (neurotransmitters) and prolonged activity of one circuit changes the balance within these messengers that toggles the switch between wakefulness and sleep creating a homeostatic effect (Refinetti, 2006; Saper, Chou & Scammell, 2001). So for example, adenosine is a metabolic product of a neurone's energy process. Its concentration increases during periods of prolonged wakefulness. But adenosine is also a neurotransmitter that is a component of the sleep cycle (Basheer, Porkka-Heiskanen, Strecker, Thakkar & McClarley, 2000). Its rising concentration during wakefulness helps to trigger the onset of the sleep cycle.

Because of its ubiquity, sleep is regarded as beneficial. However, in order to understand the benefits of sleep attention should be first drawn to the effects of sleep deprivation.

The Effects of sleep deprivation

The effects of extreme sleep deprivation have been long known by military authorities who have used it to break the will of those subjected to intense interrogation (Winston, 2003). After long periods of sleeplessness these unfortunate individuals become disoriented and their mental states fragmented. This is done in the hope that they will divulge information that in a normal state of mind they could well withhold. In reality, sleep deprived interrogatees often reach a point where they are willing to say anything that will permit them to lapse into the soothing state of sleep (Blagrove, 1996).

Even modest sleep deprivation has been linked to increased daytime sleepiness and to enervating mood states (Pilcher & Huffcutt, 1996; Talbot, McGlinchey & Harvey, 2010) including reduced ability to control irritability, frustration and anger (Kahn-Greene, Lipizzi, Conrad, Kamimori, & Kilgore, 2006). Sleep deprivation has also been linked to increased measures of stress, anxiety and depression (Kahn-Greene, Kilgore, Kamimori, Balkin, & Kilgore, 2007) and has been causally implicated in such health issues as increased allergic responses (Irwin, Wang, Campomayor, Collado-Hildago & Cole, 2006), obesity (Patel & Hu, 2008), diabetes (Knutson, Spiegel, Penev & Van Cauter, 2007) and circulatory illnesses including hypertension (Kato, Phillips, Sigurdsson, Narkiewicz, Pesek, & Somers, 2000). Research indicates that sleep deprivation reduces performance on psychomotor tasks (Edinger, Means, Carney & Krystal, 2008; Pilcher & Huffcutt, 1996) such that psychomotor performance after 24 hours without sleep can be so impaired as to be comparable to alcoholic inebriation (Weinger & Ancoli-Israel, 2002). Sleep deprivation appears to also diminish performance on such cognitive tasks as abilities to maintain focussed attention, to comprehend information, to plan, to reason and to form judgements (Harrison & Horne, 2000; Van Dongen, Maislin, Mullington & Dinges, 2003). Specifically, sleep deprivation has been linked to major deficits in the ability to encode information into memory (Walker & Stickgold, 2006). Walker and Stickgold (2006) also found that the metacognitive abilities of their sleep deprived participants were so impaired that they were not even aware of these deficits.

Research suggests that children and young adolescents are particularly susceptible to sleep deprivation and, for them, the emotional, cognitive and psychomotor effects as noted above are accentuated (Talbot, McGlinchey & Harvey, 2010). For as long as there have been schools, teachers were all too aware that the effects of chronic tiredness, irritability, frustration, inability to focus, poor comprehension and diminished coordination will, either individually or collectively, inhibit learning. It is no surprise that sleep deprivation among school children has been directly implicated in reduced learning ability and poor academic performance (Curcio, Ferrara & De Gennaro, 2006).

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The economic cost of sleep deprivation

In 2004 Access Economics examined the impact of sleep deprivation on the Australian national economy. The authority noted that sleep deprivation caused a decline in personal health, inefficiencies in the work place including accidents and lost work hours and was implicated in an array of domestic and traffic accidents. The total annual direct and indirect cost

of sleep deprivation was estimated to be 0.8% of the Gross National Product ($6.2 billion at that time). If the same statistic held in 2014 the national cost of sleep deprivation would be near to $30 billion.

Sleep as a restorative process

The activities of a busy day produce the sense of tiredness and the desire to sleep. It is argued that the activities of the day come at a cost to the body. Waste builds up, tissues are stressed or damaged and bodily resources are depleted (Refinetti, 2006). As a result, sleep provides opportunity for much of the body's restorative processes to occur. These include the removal of waste, the supply of nutrients, the release of hormones, protein synthesis, and the processes of growth and tissue repair.

> *Sleep is a complex behaviour that plays a part in neural development and is essential to human physiological, cognitive, emotional, and social wellbeing*

The neuronal activity of conscious awareness also comes at a cost. An active brain demands energy in the form of glycogen and produces waste that includes adenosine. This waste becomes toxic if permitted to accumulate. Evidence is now growing that sleep also permits restorative activity to occur inside the brain itself. The Nedergaard team of researchers (Xie et al., 2013) have found that during sleep channels controlled by the glia cells inside the brain (these act as support cells to the neurones) open and permit cerebrospinal fluid to mix with the neuronal interstitial fluid (cell fluid that bathes the neurones). They suggest that this process flushes the metabolic waste from the neurones – including the accumulated adenosine. The lowered activity associated with sleep allows appropriate levels of glycogen to be restored in preparation for the following period of wakefulness. The removal of adenosine from the vicinity of those neurones associated with the arousal system primes them for the activity of the following day (Schwartz & Roth, 2008). This cleansing process suppresses the sleep trigger and helps re-establish a state of conscious alertness that is capable of focusing and maintaining attention and establishing links between immediate external stimuli and neuronal records of prior learning.

REM sleep and neural development

Brain activity characteristic of REM sleep first appears at a gestation age of about 30 weeks and dominates the sleep cycles of the foetus and the first six months of life (Graven & Brown, 2008). It takes until 9 months of age before the infant approaches the sleep proportions between NREM and REM sleep (approximately 80% of sleep is NREM) that will be roughly characteristic of later life. Graven and Brown (2008) note that persistent abnormalities in REM sleep between 30 weeks gestation age and six months result in disorders in specific sensory neural pathways. The authors argue that normal neural activity during REM sleep is crucial to development of neural pathways through the visual, auditory and touch sensory systems. It is Siegel's opinion that neuronal activity within REM sleep is essential for "making brain connections during crucial periods of development" (Siegel, 2005, p. 1269).

There is one question that arises. If REM sleep was important during development, why does it persist in the lives of adults? Siegel (2005) argues that in adults the role of activity in REM sleep is to reverse the unconscious state of NREM sleep.

Deep NREM sleep and consolidation of long-term memory traces

Research over the past two decades has linked deep NREM sleep with memory trace consolidation within long-term storage (Ellenbogen, Payne & Stickgold, 2006; Gais & Born, 2004; Ribeiro, 2012; Walker, 2009; Walker & Stickgold, 2004; Walker & Stickgold, 2006). In particular it has found evidence that suggests that deep NREM sleep aids in the long-term stabilisation of memory traces for: life events (episodic memory traces - Hu, Stylos-Allan & Walker, 2006; Payne, Stickgold, Swanberg, & Kensiger, 2008; Van der Helm, Gujar, Nishida & Walker, 2011); 'know that information' (semantic memory traces - Tamminen, Lambon Ralph, & Lewis, 2013); emotions (affective memory traces – Chambers & Payne, 2014; Payne & Kensinger, 2011); and memory traces that coordinate and drive procedural skills (memory traces for psychomotor activities - Fischer, Nitschke, Melchert, Erdmann & Born, 2005; Nishida & Walker, 2007).

So, sleep is a complex behaviour that plays a part in neural development and is essential to human physiological, cognitive, emotional, and social wellbeing. Deep NREM sleep also is involved in the consolidation of long-term memory traces. What is recommended in terms of the amount of sleep per age? What are the current sleep habits of young people?

Adolescent sleep patterns

The Sleep Health Foundation of Australia (2011) published a table of healthful sleep requirements that suggests that teenagers should average between 8.5 hours and 9.5 hours sleep per night. However, an Australian study (Olds, Maher, Blunden & Matricciani, 2010) indicated that on school days south Australian children and teenagers (of both genders) between the ages of 9 and 17 plus years averaged just over 7 hours of sleep per night. On non-school days this rose to an average of over 8 hours of sleep per night. Further, the authors pointed out that the average of adolescent time-in-bed for South Australian teens declined by 30 minutes between 1985 and 2004. Members of the same research team then began a broader study

involving child and adolescent sleep times across the world. In a meta-analysis of 97 studies published between 1905 and 2008 that involved 690,747 subjects aged between 5 and 18 years, they found that the average hours of sleep per night progressively declined (Matricciani, Olds & Petkov, 2011). Further, they found that this decline totalled to a loss of more than 77 minutes of sleep per night over the 103 year-duration of data employed in the study.

Research Questions

Since sleep is important and sleep deprivation potentially has a significant impact on students:

1. What is the nature of the sleep patterns among the students of Seventh-day Adventist secondary schools across Australia?
2. What are students' perceptions of their own sleep habits and of their experience of daytime sleepiness?
3. What factors are related to these perceptions of sleep habits and daytime sleepiness?

Method

The sleep data were collected as a part of a larger study involving the use of a questionnaire. Respondents provided a range of knowledge of information and responded to questions concerning their sleep habits and its effects. These questions were adapted from the School Sleep Habits Survey created by the Sleep Research Lab (1994). Among these questions were two blocks of items, each set against its own Likert scale, that gave rise to the two perception scales 'Poor Sleep Habits' and 'Struggling to stay awake'. The resulting data were analysed using IBM SPSS statistical package (IBM Corporation, 2011).

Results

Respondents

Just over 1,000 students from 12 Seventh-day Adventist secondary schools spread from South Queensland to Western Australia completed the survey. Of these, there were 945 usable results. Of the 945 respondents: 454 were male, 486 were female and five respondents did not indicate their gender; 180 were aged 14 years, 307 were aged 15 years, 276 were aged 16 years, 179 were 18 years or over and three did not indicate their age; 363 indicated their religion as Seventh-day Adventist, 313 gave their religion as another Christian denomination, 96 identified as being of a non-Christian religion, 160 were of no religion and 13 did not provide a response.

Length of Sleep

Table 1 provides the number of hours of sleep as calculated from the respondents' declared times for going to bed and their declared rising times. This table indicates that 18% of the respondents were indirectly claiming as little as 6 hours sleep per night and that toward half of the respondents (46%) were getting less than the recommended number of hours of sleep per night for an adolescent. Most respondents know they are getting too little sleep. In addition, 15% felt that they rarely or never had sufficient sleep and 23% considered that they were poor sleepers. Even so, 12% of the respondents suggested that they could get by on less than the recommended number of hours of sleep for adolescents.

However, just over half (55%) of the respondents reported adequate sleep (see Table 1), more than half (69%) felt that they needed the recommended number of hours sleep per night, just over a one half (53%) felt that they usually or always got enough sleep, and 77% thought that they were good sleepers.

Are these results confusing? Yes. But they do suggest that toward one in every two students in Seventh-day Adventist secondary schools could well be at risk of having less than the recommended hours of sleep and that one in every 5 students are falling well short of what would be regarded as a healthy night's sleep. They also suggest that many students may be unsure of what an adequate night's sleep should be and that some may over-estimate the quality of their own sleep.

Domestic Stability

This study also surveyed the sleeping arrangements of the respondents. Approximately 70% of all

> *"18% of the respondents were indirectly claiming as little as 6 hours sleep per night and that toward half of the respondents (46%) were getting less than the recommended number of hours of sleep"*

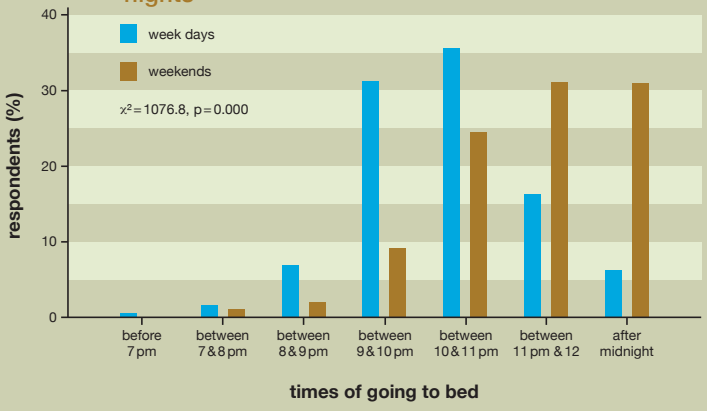
Table 1: Hours of sleep as calculated from bed-times and rising-times

hours of sleep	male	female	total
6 hours or less	69 (16%)	97 (20%)	166 (18%)
7 hours	135 (30%)	126 (26%)	261 (28%)
8 hours	156 (35%)	179 (37%)	335 (36%)
9 hours	79 (18%)	75 (16%)	154 (17%)
10 or more hours	9 (2%)	5 (1%)	14 (2%)
total	448	482	930
missing			15

respondents indicated that they slept in the same bed every night. A further 26% were in the same bed almost every night and 5% slept in the same bed a few nights. It is possible that these two transient groups of students split their time between caregivers who live separately. Finally nine respondents indicated that they did not sleep in the same bed each night. It is possible that these students were 'couch surfing' - moving between the homes of relatives and friends. This study will later examine the effect that these different sleeping arrangements have upon the quality of sleep reported by these students.

"5% slept in the same bed a few nights. … [and] split their time between caregivers … nine respondents indicated that they did not sleep in the same bed each night. It is possible that these students were 'couch surfing'"

Figure 1: Sleep patterns for week nights and weekend nights



Special Nature of Weekend Nights

Figure 1 provides the going-to-bed times for week-day nights and weekend nights. A glance is all that is needed to realise that the to-bed times of the weekend are considerably later than the to-bed times of the week nights. The Chi-square measure of 1076.8 ($p = 0.000$) indicates the strength of these differences. They suggest that within the Seventh-day Adventist school culture there is a qualitative difference between the respondents' perceptions of the week-nights and the weekend nights. Anecdotal information would suggest that school nights are for study and home activities and weekend nights are for social gatherings.

Academic performance

The literature review suggests that the amount of sleep and its quality has an impact on students' academic performance. Students were asked to give a self-assessment of their academic performance. With 75 elements of missing data, this was the one item in which respondents were most reticent to provide information. It was also a variable where respondents appeared more willing to fudge boundaries. For example, 13% of the respondents placed themselves in the lower one-third of the spread of academic achievement, 48% indicated membership in the mid one-third of the class and 39% saw themselves as belonging to the upper one-third of academic achievement.

The perception scales: 'Poor sleep habits' and 'struggling to stay awake'

Confirmatory factor analysis as applied to the two blocks of perception items produced two strong factors (see Table 2).

In this factoring process items that loaded weakly and whose presence reduced scale reliability were removed. The first factor gave rise to Scale 1 and included descriptions of behaviours that were collectively indicative of 'Poor Sleep Habits'. The second factor gave rise to Scale 2 and included descriptions of behaviours that indicated difficulty in remaining alert and awake during daytime activities. This factor was labelled 'Struggling to stay awake'. Scale scores for each factor were created by assigning each respondent the mean values for their Likert scores for the items within each of the two factors. High scores on the scale 'Poor sleep habits' represent experiences of poor sleep habits and high scores on the scale 'Struggling to stay awake' indicate real problems with remaining alert and attentive during daytime activities.

More than three quarters of the respondents reported that their experiences of sleep were 'generally good' or better. However the remainder reported sleep experiences that were 'poor' or 'very poor' (Figure 2a). More than three quarters of the respondents had little problem in remaining aware and awake during the day (Figure 2b). However the remainder indicated that they often struggled to remain awake and some even reported instances of falling asleep during daytime activities.

Causality: Poor sleep and difficulty in remaining alert

The literature presents a strong argument for a causal link between the quality of sleep and the ability to remain alert (Curcio, Ferrara & Gennaro, 2006; Pilcher & Huffcutt, 1996; Talbot, McGlinchey & Harvey, 2010). Assuming this to be so, a regression equation with 'Poor sleep habits' as the

Table 2: Factor loadings for the scales 'Poor sleep habits' and 'Struggling with day-time sleepiness'

scale 1: poor sleep habits ($\alpha = 0.71$)	**loading**
In the last two weeks I:	
have stayed up to at least 3 am	0.73
have stayed up all night	0.71
have slept past noon	0.60
have had nightmares or bad dreams	0.55
have gone to bed because I couldn't stay awake	0.53
have arrived at school late because I overslept	0.49
have had an extremely hard time falling asleep	0.46
have needed more than one reminder to get up in the morning	0.42
have woken too early and been unable to go back to sleep	0.41
scale 2: struggling with daytime sleepiness ($\alpha = 0.73$)	**loading**
In the last two weeks I:	
struggled to stay awake while reading and doing homework	0.67
struggled to stay awake in class	0.66
struggled to stay awake during a test	0.66
struggled to stay awake while working on the computer	0.59
struggled to stay awake during a movie, concert, or a play	0.57
struggled to stay awake while playing video games	0.52
struggled to stay awake while travelling by bus, train, plane or car	0.51
struggled to stay awake while watching TV or listening to the radio	0.47
struggled to stay awake during face-to-face conversation	0.47

independent variable and 'Struggling to stay awake' as the dependent variable produced a β coefficient of 0.46. This implies that a one standard deviation change in 'Poor sleep habits' will cause almost a half of a standard deviation change in 'Struggling to stay awake'. It also means that 'Poor sleep habits' will explain 21% of the variance in 'Struggling to stay awake'. This suggests a strong causal link between poor sleep habits among the respondents and their resulting difficulty in remaining alert during the day.

Relationships involving 'Poor sleep habits' and 'Struggling to stay awake'
Analysis of variance was used to examine differences in mean values on the two scales ('Poor sleep habits' and 'Struggling to stay awake') for a variety of demographic and behavioural variables. The 95% level of confidence ($p < 0.05$) was used to determine non-chance results. Cohen's d statistic (a measure of effect size) was employed to provide a measure of the magnitude of the separation in mean values. Cohen's d statistic is the proportion of a pooled standard deviation that separates two mean values. Values of Cohen's d from: 0.20 - 0.49 are regarded as representing a small to moderate effects; 0.50 - 0.79 as representing moderate to strong effect; and anything over 0.80 as representing a large effect (Gravetter & Wallnau, 2009).

The effects of reduced hours of sleep
The data indicated that as the hours of sleep decreased in hourly increments from '10 or more hours of sleep' to 'six or less hours of sleep' the corresponding calculated mean measures on both the scales 'Poor sleep Habits' and 'Struggling to stay awake' increased (see Figures 3a and 3b). This inferred that decreasing hours of sleep were associated with increasingly poor sleep habits and with increasing instances of sleepiness during the day. The differences between the mean values were strong as indicated by the F ratios (12.00 and 8.12 respectively) and by moderately strong Cohen's d statistics. These results are consistent with expectation and therefore contribute to a perception that the two scales are valid and robust.

> *"Decreasing hours of sleep were associated with increasingly poor sleep habits and with increasing instances of sleepiness during the day"*

Gender differences
The data indicated that girls averaged slightly higher scores than boys on both the 'Poor sleep habits' scale and on the 'Struggling to stay awake' scale. While these differences were small (d = 0.27 and d = 0.26 respectively) they were not chance results (F = 16.43; p <. 0.001 and F = 16.75; p < 0.001 respectively).

Differences associated with religious affiliation
Figure 4 shows scores on the 'Poor sleep habits' scale for students of different religious affiliations. This indicates that students who indicated their religion as Seventh-day Adventist had better sleep habits and had less difficulty in remaining alert than did students indicating other Christian convictions and students from non-Christian backgrounds. The differences in mean scores on the 'Struggling to stay awake' scale for students of differing religious backgrounds are not significant and could have occurred by chance.

> *Differences in mean scores on the 'Struggling to stay awake' scale for students of differing religious backgrounds are not significant*

Figure 2: Whisker plot showing the range, median and quartile measures of the scales 'Sound sleep habits' and 'Struggled to stay awake'

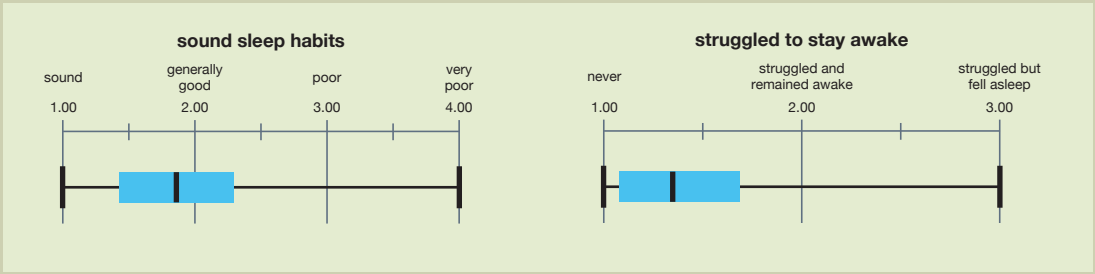
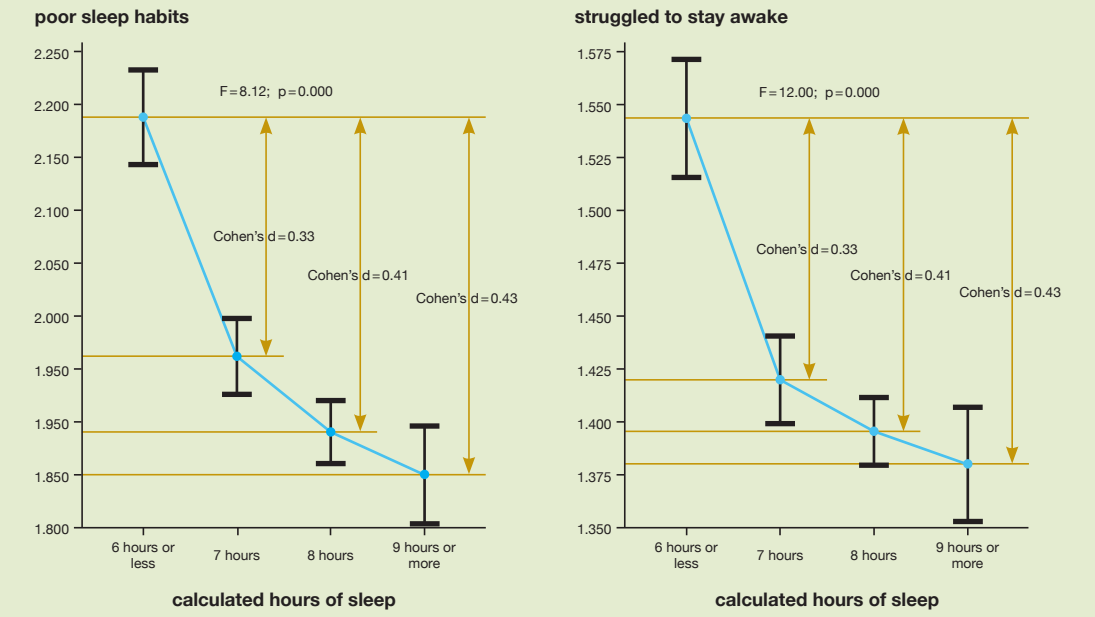


Figure 3: Measures of 'Poor sleep habits' and 'Struggled to stay awake' vs 'Calculated hours of sleep'



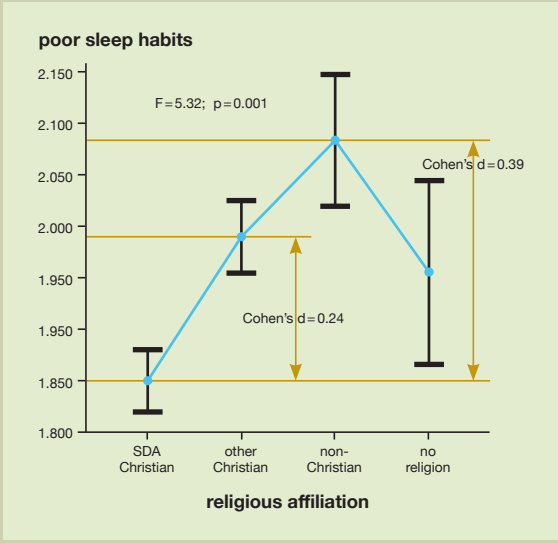
Differences associated with the language of the home

Students from homes where the language of communication was not English had slightly higher scores on the two scales, 'Poor Sleep Habits' and 'Struggling to stay awake' than students from homes in which the language of communication was English ($F = 7.27$; $p < 0.01$; $d = 0.25$ and $F = 6.31$; $p < 0.05$; $d = 0.23$ respectively). That is, those from homes in which English was the spoken language had slightly better sleep habits and found it easier to remain alert during the day than did those from homes in which a language other than English was the main means of communication. While the differences were small, they were significant and not chance results.

Differences associated with sleeping arrangements

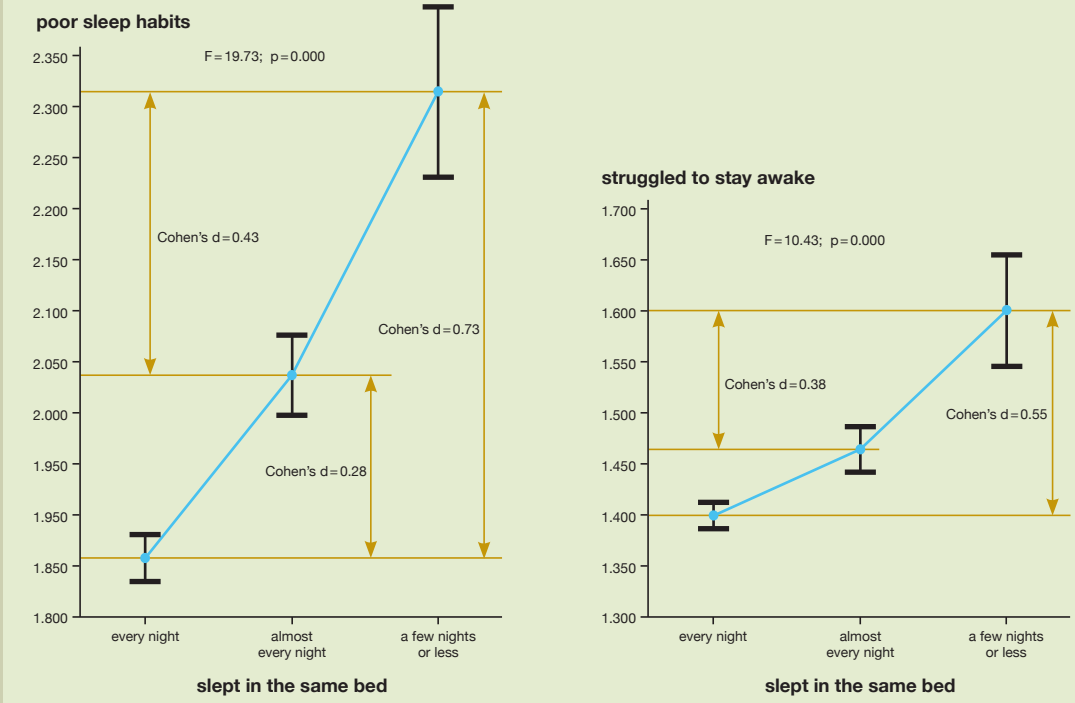
Figures 4a and 4b present the results of an examination of the effects that respondents' sleeping arrangements had on their sleep habits and on their ability to remain alert during the day. Three groupings of weekly sleeping

Figure 4: Measures of 'Poor sleep habits' against stated religious affiliation



> *Those from homes in which English was the spoken language had slightly better sleep habits and found it easier to remain alert during the day*

Figure 5: Measures of 'Poor sleep habits' and 'Struggled to stay awake' vs 'Slept in the same bed'



arrangements were employed. The first included those who 'slept in the same bed every night', the second included those who 'slept in the same bed almost every night' and the final group included those who 'slept in the same bed a few nights or less'. These three groups produced distantly separated mean scores on the scale, 'Poor sleep habits' (see Figure 5a). The mean scores on the scale rose in quantum leaps with each movement from 'slept in the same bed every night' through to 'slept in the same bed a few nights or less'. The F ratio of 19.73 and the Cohen's d statistics ranging from 0.28 to 0.73 indicated strong, meaningful and significant separation of the three mean scores. The implication is that having a single, secure and permanent personal space for sleeping contributes strongly to the experience of sound and refreshing sleep habits.

The mean values for the three sleeping arrangements produced a similar pattern of separation of mean scores on the scale 'Struggling to stay awake' (see Figure 5b). Those whose sleeping arrangements were stable exhibited less difficulty in remaining alert while those who slept in the same bed only a few nights or less each week struggled more with remaining awake. Again the F ratio was strong (10.43) and the Cohen's d statistics (0.38 and 0.55) indicated meaningful separation.

Differences associated with personal assessment of class position

The literature review has built the case that sleep both prior to and following a learning experience is related to memory formation. The results of this study indicate a tenuous link with this proposition. Those who placed themselves in the lower academic third of the class indicated the poorest sleeping habits and the greatest problems with daytime sleepiness. Similarly those who placed themselves in the upper third of the class indicated the least problematic sleeping habits and the least problem with daytime sleepiness. The differences between the mean scores in each distribution were robust as indicated by the respective F ratios ($F = 25.95$; $p < 0.001$ and $F = 18.29$; $p < 0.001$) and by the strong measures of the Cohen's d statistic, which ranged from 0.35 to 0.71 and 0.28 to 0.59 respectively.

> *"Those whose sleeping arrangements were stable exhibited less difficulty in remaining alert while those who slept in the same bed only a few nights or less each week struggled more with remaining awake"*

Conclusion

These results were not only internally consistent; they were also consistent with the literature that indicates adequate quality sleep is vital to emotional and physical wellbeing and to efficient learning. The literature also indicates that there is a worldwide decline in both the adequacy and quality of sleep enjoyed by adolescents. This decline is reflected in the results of this study.

The results of this study provide a snapshot of the patterns of sleep of the students in Seventh-day Adventist schools (Research Question One). This snapshot suggests that a significant minority of students are not getting sufficient sleep. The literature would suggest that this is likely to have an effect on their health and their learning. The study found that almost one half of the students involved in the study, were getting less than the recommended amount of sleep. Further, that approximately one in five of these students were surviving on six or less hours of sleep per night. Approximately one in four of these students indicated that they rarely or never get enough sleep and approximately one in four regularly sleep in a different bed. In addition, the pattern of sleep on the weekends was found to be significantly different from that of the weekday nights with a larger proportion of students retiring to bed much later on the weekends.

The scales 'Poor sleep habits' and 'Struggling to stay awake' were created to provide measures of the student's perceptions of, respectively, the quality of their own sleep and their daytime somnolence (Research Question Two). These scales were found to be reliable and consistent with the literature. For example, they matched the expected causality in that they exhibited 21% of common variance and further, that students' sleep habits became increasingly poor and students faced greater difficulty in staying awake, as their hours of sleep declined. Measures on these scales suggested that approximately one in four students perceived their sleep habits to be moderately poor and one in four indicated that they suffered from daytime sleepiness.

These scales permitted poor sleep habits and difficulties with daytime sleepiness to be related to a range of other factors (Research Question Three). For example, girls indicated slightly poorer sleep habits and difficulties with daytime sleepiness than did boys. Similar results were found for those from a non-English speaking background over those from an English speaking background. Further, students from Seventh-day Adventist backgrounds indicated fewer problematic sleep habits than those of other religious backgrounds.

One factor did emerge as being interesting and important. Those students who appeared to move between two or more domestic arrangements reported more difficulties with their sleep habits than those who had a single place of abode. These results were robust. The academic performance of students who frequently moved between alternative domestic arrangements suffered as a result.

Finally, academic performance was clearly linked to the quality of sleep and daytime alertness.

These results raise further questions that need to be asked of students in Seventh-day Adventist

schools. For example, what are the causes of the decline in the quality and the length of sleep among students? What are the attitudes of students toward sleep? What do students think could be done to encourage young people to take greater care of their own welfare? Is there, among students, pressure to use substances to combat daytime sleepiness?

Finally, the quality of sleep is related to good health. Therefore adequate sleep becomes a component of personal hygiene. Promoting better sleep habits is as important as any other factor related to the personal development of students. If teachers know that a significant minority of their students are not getting sufficient sleep they can mount a sustained campaign to change that situation.

TEACH

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