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Original article

Sleep health, messaging, headaches, and academic performance in high school students

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Abstract

Aim: We tested for associations of bedtime, sleep duration, instant messaging, and chronic headaches with hypersomnolence and academic performance in a sample of high school students in New Jersey, USA.

Methods: Students were surveyed anonymously and asked to report their sleep and messaging habits, headache status, and overall grades.

Results: We found that greater hypersomnolence was associated with later bedtimes, shorter sleep durations, and the presence of chronic headaches, but not with messaging after lights out. Also, we found that academic performance was lower in students who messaged after lights out, but it was not affected by headache status, bedtime, or sleep duration.

Conclusions: These results are consistent with other studies that have demonstrated associations between headaches and hypersomnolence and between instant messaging habits and academic performance. They also add to a growing literature on the relationships among use of electronic devices, sleep health, and academic performance by adolescents.
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Keywords: Text messaging; Adolescents; Sleep health; Sleepiness; Academic performance; Headaches

1. Introduction

Sleep quality and quantity are important variables in the health of all individuals, especially adolescents. For example, sleep insufficiency is associated with a variety of negative health conditions, including increased weight gain, substance abuse, and depressive mood symptoms [1]. Despite sleep's importance, high school students have reported a preference for later bed times, in part due to their physiologic delayed circadian rhythm, which are associated with shorter sleep durations when the school start is in early morning [2,3]. Thus, it is not surprising that in a survey of students in the United States, including high school students, 70% of respondents reported insufficient sleep on school nights [4].

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In addition to health concerns related to inadequate sleep duration and quality, academic performance can be negatively affected by sleep quality and by chronic sleep insufficiency occurring on both weekends and weekdays [5–7]. For example, students in Finland with bedtimes after 10:00 PM reported diminished motivation and ability to prepare for exams, complete homework, and complete tasks in school relative to students with earlier bedtimes [8]. These trends were even more robust with bedtimes after 11:30 PM. Repeated instances of insufficient sleep are described as chronic partial sleep deprivation, which affects cognitive performance, speed, and accuracy [9]. As a possible explanation for the relationship between sleep and performance, both REM and non-REM sleep have been shown to be integral to knowledge consolidation and skill consolidation in children and adolescents [10–12].

There are many factors that can influence the quality and quantity of sleep experienced by an individual, but two variables of recent interest are use of electronic devices for messaging and chronic headaches. Exposure to electronic media is pervasive, with an average exposure for adolescents in the United States of eight hours per day [13]. Not only is exposure lengthy, it often occurs near bedtime. In a national survey, approximately 54% of US students in 9th to 12th grade used instant messaging and/or the internet an hour prior to going to bed [2]. Further, 34% of adolescents surveyed in Pennsylvania, USA used their cell phones for text messaging after 9 PM [14]. This trend is not isolated to the US, because more than half of adolescents surveyed in Belgium reported texting after lights out at some point during the preceding month, with 15% of students sending more than 10 messages after lights out [15].

These actions could have direct impacts on sleep health and academic performance. Both texting more than once after lights out and using one's cell phone several times a week have been shown to influence the likelihood of daytime fatigue and sleepiness in Belgian adolescents [15]. Further, use of cell phones after lights out by Japanese adolescents was associated with various sleep disturbances including short sleep duration, self-reported poor sleep quality, insomnia symptoms (increased sleep onset and frequency nighttime wakefulness), and excessive daytime sleepiness (hypersomnolence symptoms) [16]. In another study of Japanese students, greater cell phone use after lights out was associated with decreased sleep length in early adolescents (7th to 9th grade) but not in late adolescents (10th to 12th grade), although across both age groups cell phone use after lights out was associated with higher rates of suicidal feelings and self-injury [17]. Finally, increased use of instant messaging was associated with lower grades in a study of college students in the US [18]. As a possible explanation for these findings, prolonged exposure to electronic displays can result in nocturnal melatonin suppression or a delay of melatonin release through increased nocturnal stimulation of the circadian system [19,20].

Headaches are a second factor that could influence sleep health and academic performance in adolescents. De Tommaso et al. found that shorter sleep duration was associated with headache frequency and severity in a study of Italian patients [21]. In a study conducted in Pennsylvania, USA, Peres et al. found that excessive daytime sleepiness was associated with migraines and that Epworth sleepiness scores (ESS) were higher in individuals with migraines than in individuals without migraines [22]. Further, higher ESS were associated with mental fatigue, concentration problems, and memory issues. These latter symptoms could obviously affect academic performance, and headaches have been shown to negatively affect academic performance in several studies [23–25].

The relationship between headaches and sleep health is complicated, because each can affect the other [22]. For example, Houle et al. reported that sleep insufficiency was a common trigger of headaches and that sleep duration was a strong predictor of headache risk [26]. Further, Calhoun and Ford demonstrated that behavioral sleep therapy and intervention helped reduce headache frequency and induced reversion of transformed migraine into episodic migraine in adults, thus showing that improvement in sleep hygiene could alleviate headache symptoms [27].

Individuals may experience headaches independent of electronic device usage, but there is also evidence to suggest that the two could be linked. That is, several studies have shown an association between cellular phone usage and occurrence of headaches [28–30]. While these studies have focused on the use of the phone for voice communication and not text messaging, Srinivasan et al. found that melatonin is able to act as an antinociception agent for migraine patients, who were found to have lower melatonin levels than healthy patients [31]. Given the relationship between electronic screen viewing and suppressed melatonin production described earlier [19,20], it is possible that use of a phone for messaging could also lead to headache.

In this study, we tested for associations between selected behavioral and physiological variables (bedtime, sleep duration, instant messaging, chronic headaches) and hypersomnolence (excessive sleepiness) and academic performance in a sample of high school students in New Jersey, USA. We predicted that earlier bedtimes and longer sleep durations would be associated with less hypersomnolence and better academic performance. We also predicted that instant messaging and chronic headaches would be associated with more sleep problems and worse academic performance, perhaps in a synergistic fashion.

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