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Interrupted sleep: College students sleeping with technology

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ABSTRACT

Objective: To examine the influence of cell phones and sleep quality among college students and the prevalence of sleep texting. **Participants:** Participants were 372 college students at two mid-size universities in 2013. **Methods:** A survey was used to ask about cell phone use during sleep and sleep quality. Students were asked about hours of sleep, both on a school night, and over the weekend in addition to location of cell phone. **Results:** A quarter of the sample (25.6%) reported sleep texting behavior along with poor sleep quality and the cell phone influencing their sleep ($p < .05$). Students that sleep text were more likely to report sleep interruption ($p < .000$), to place their phone in bed with them ($p < .000$), have no memory of texting (72%) or what they texted (25%). **Conclusions:** Sleep texting and its influence on poor sleep habits is a growing trend in a college student population.

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Sleep is a vital indicator of overall health and well-being as well as an important component of individual wellness since it affects daily functioning as well as physical, emotional, and mental health.[1–3] Humans spend up to one-third of their lives asleep, and the overall state of an individual's *sleep health* remains an essential question throughout our lifespan. Sleep needs vary across ages and are especially impacted by lifestyle and health.[4,5] Most adults know that getting a good night's sleep is important, but too few actually sleep for eight or more hours or make it a priority behavior. In 2011 a national sleep survey reported that, among 74,571 adult respondents, 35.3% reported less than seven hours of sleep during a typical 24-hour period; 37.9% reported unintentionally falling asleep during the day at least once in the preceding month; and 4.7% reported nodding off or falling asleep while driving at least once in the preceding month.[3]

When considering sleep loss, there is a distinction made between total and partial sleep deprivation. Total sleep deprivation occurs when a person is awake for more than 24 hours at a time, with absolutely no sleep. Partial sleep deprivation is different; when a person is experiencing partial sleep deprivation, they are sleeping every night but they are not getting enough sleep.[6] For example, if a person requires 8 hours of sleep but only gets six each night for a week, they have entered into partial sleep deprivation. This culminates in a "sleep debt", the difference between the hours you should be getting and the hours you actually get. This debt can be difficult to repay: instead of one extended sleep session, an hour or two must be tacked on each night to catch up. As this deficit increases, people begin to feel the consequences; sleep deprivation has an effect on both mental physical health.[2]

Young adults who are college students tend to sleep less than other age groups with many reporting an average of six to 6.9 hours of sleep per night.[3,5] Having minimal adult supervision, erratic schedules, academic pressure, and easy access to over-the-counter, prescription and recreational drugs, college students can be a population particularly susceptible to the deleterious effects of poor sleep. Insufficient and irregular sleep has been well documented among college students.[4,6–10] Poor sleep quality, often caused by college students' self-imposed sleep deprivation[8] and irregular sleep schedules[3,7], can lead to significant emotional imbalance,[10] fatigue,[4,10,11] poor concentration,[11] impaired memory,[4,9–12] and generally lower life satisfaction.[4,12]

The underlying causes for poor sleep among college students may be complex and multi-factorial. College students often report being sleep deprived, have poor sleep habits, experience poor sleep quality[3,7,8] often

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reporting that technology use and access has affected their sleep habits.[2] Utilization of cell phones and texting have become the main means of personal communication for many people. Texting is especially high in adolescents and young adults, who are exchanging as many as 60–100 text messages a day.[13] The "24/7," "always on" nature of society, compounded by easy access to cell phone, Internet, television, and other media may have significantly contributed to the sleep deprivation and poor sleep experienced by young adults.[14]

In today's world almost everyone has a cell phone which can be used to call or text anyone, just about anywhere. New technology has enabled phones to become "smart" data devices used for online access, music capability, photo sharing, video streaming, and other applications that can be used in everyday life. This ability to text does not stop at bedtime, and the phenomenon known as "sleep texting" is emerging as a growing technology trend among adolescents and young adults. Sleep texting occurs when an individual responds to or sends a text message electronically while in a sleep state. The beep or buzz of the cell phone indicating that a call has come in awakens the sleeper, who instinctively reaches over and responds to the message. This action can occur once or multiple times during the sleep cycle, adversely affecting the quality and the duration of the individual's sleep.

Anecdotally, college age students who sleep text report that most of their messages are gibberish or nonsensical responses to questions. This finding is supported by an August 29, 2017 Google search of the social media platforms Twitter and Tumblr which indicated that users regularly recount the "ridiculous" messages they've sent with the hashtag #sleeptexting. Examples from this search include: "*Lips I dripped it,*" "*I legittt wish veggird were enough to fuelme*," and "*It means Girls tonight. It I 10.*" Other social media sites such as Twitpics and Instagram have photos showing users' unique or garbled messages, frequently containing more gibberish than actual words.

The action of sleep texting, viewed independently, suggests that the messages being sent are more embarrassing than dangerous. It is important to note that these postings are made by older adolescents or college students, almost all of whom are most likely not currently members of the work world interacting with clients, bosses, administration, or fellow employees. Sleep texting amongst the working population may result in a different experience and a different set of consequences based on what was texted-and to whom when viewed through a professional work lens.

To better understand technology via cell phone use during sleep a study with young adult college students was developed using a one-time anonymous survey to identify cell phone use and sleep habits. College students were chosen because they have a well-earned reputation for getting the least amount of quality sleep when compared with other age groups. The goals of this pilot study were to explore the frequency and duration of cell phone use during sleep by asking what is the influence of technology on the sleep patterns of college students, what are the sleep texting experiences of college students, and, if a college student is sleep texting are there any differences between students who sleep text and those who do not sleep text?

Methods

This study used a questionnaire to survey college students about their cell phone during sleep and sleep quality. The survey was administered in April 2013 at two mid-size, private universities located in the Northeastern United States. The study was approved by the Institutional Review Board at both University A and B. All surveys were given in-person, as paper and pencil instruments, with the first page containing informed consent. The anonymous 18- question survey was administered to three separate classes consisting of college students who were sophomores, juniors, or seniors. The response rate for the sample was quite high with class #1 at University A having 100% response rate (184/184). At University B, class #2 had a 96% response rate (100/104) and class #3, the senior level class, had an 84% response rate (38/45). Students were asked about hours of actual sleep, both on a school night, and over the weekend. Descriptive and correlational statistical analyses were used with this study's convenience sample. All variables were screened for systematic and nonsystematic missing data, outliers, and logistical inconsistencies with other variables. When variables were examined by school (University A versus University B) there were no significant differences noted between the two schools but there were sex differences noted.

Results

Sample demographics

The sample consisted of a total of 372 college students, 75% female ($n = 282$) and 25% male ($n = 90$), with the average respondent age being 19.7 years (range 19–21; $SD = .6$). One hundred percent of the sample's mobile or cell phone was

identified as being a "smart phone." Questions about specific phone brands or mobile operating systems were not asked. Information regarding race/ethnicity or grade point average was not gathered.

College students were first asked questions about their sleep, eg, "*What type of sleeper are you?*" Over half (56%) of the students identified themselves as being a medium sleeper, 33% were heavy/deep sleepers and 11% were light sleepers. Hours of sleep on a school night ranged from two to 10 hours ($M = 6.5$) with the most common response (30%) being seven hours of sleep (Table 1). Amount of hours slept on a weekend night ranged from one to 12 hours ($M = 8.5$), with the most common responses indicating more sleep than on a school night. Some 70% of respondents indicated sleeping eight hours or more on weekend nights. Students were also asked about the quality of their sleep with the majority, (65%) responding that their sleep was *fairly good*, 18% had *very good sleep*, 16% had *fairly bad sleep,* and *1% (n = 5)*, had *very bad sleep* (Table 1).

The majority of students (93%) reported keeping their cell phone with them at night. Questions asking about cell phone use during sleep, "*Have you ever answered your cell phone in your sleep*?" Found approximately one- third of the total sample (30%) answered "*yes*" with significantly more woman (90% vs. 10%; $X^2 = 19.971$, $p = .000$) reporting the behavior. Questioning about the location of the cell phone during sleep garnered some interesting responses, with the majority of students placing the phone either next to the bed (67%) or in the bed (28%) with them. Within the total sample the majority of male students (80%) placed their phone next to the bed compared to 63% of the female students ($X^2 = 8.724$, $p = .003$). In contrast when asked "*Do you put the cell phone in bed with you?*" there were significantly more woman than mens who answered "*yes*" (52.6% vs. 47.4%; $X^2 = 9.136$, $p = 0.002$). Over half of the sample, 57%, reported that they do not mute or place the cell phone on vibrate or airplane mode at night, with more woman (61.8%; $p = .001$) keeping the ringer on. When asked if they turn the phone off at night, the majority of the total sample (67%; $n = 249$) responded "*no*." The majority of these students (65%; $n = 242$) also responded "*no*" to the question *Do you feel using a cell phone at night influences your sleep?*

Sleep texting

When asked "*Have you ever texted in your sleep?*" over one-quarter of the total sample (25.6%) responded that they had texted, with more female students (86% vs. 14% respectively) reporting the behavior. There were again sex differences, with over one-quarter of the females (26.5%) sleep texting, compared to only 13.3% of males who reported the behavior. Sleep texting students, were asked "*When did this behavior begin?*" The majority (62%) reported this as a new behavior having only started in college, 30% reported the behavior as occurring in both high school and college, with the remaining 8% having started in high school.

The majority of students (72%) who sleep text reported not remembering the behavior. When asked how the student discovered they had texted in their sleep the overwhelming majority (95%) had read their phone history upon waking up, the remaining five percent were told by a friend about the text. Using their phone history to see where the sleep text was sent, the majority (65%) reported they had sleep text a friend, while 35% texted to a boyfriend or girlfriend.

Table 1. Quality of sleep.

Type of sleeper	Men	Women	Total
Light	5 (1.3%)	38 (10.2%)	43 (11.5%)
Medium	49 (13.2%)	155 (41.8%)	204 (55%)
Heavy	37 (9.0%)	88 (24.5%)	125 (33.5%)
Sleep quality	Men	Women	Total
Very good sleep	14 (16.5%)	50 (18.3%)	64 (17.9%)
Fairly good	52 (61.2%)	180 (65.9%)	232 (64.8%)
Fairly bad sleep	16 (18.8%)	41 (15%)	57 (15.9%)
Very bad sleep	3 (3.5%)	2 (0.7%)	5 (1.4%)
Ever texted in your sleep?	Men	Women	Total
Yes	12 (3.2%)	75 (20.2%)	90 (24.2%)
No	78 (21.0%)	207 (55.6%)	282 (75.8%)
Type of sleeper	Yes Sleep Texting	No Sleep Texting	Total
Light	8 (9.1%)	35 (12.3%)	43 (11.6%)
Medium	47 (53.4%)	157 (55.3%)	204 (54.8%
Heavy	33 (37.5%)	92 (32.4%)	125 (33.6%)

Sleep texting students (72.6%) were more likely than non-sleep texting students (17.2%) to report having ever answered the phone in their sleep ($X^2 = 96.419$, $p = .000$; missing 10.2%), had lower sleep quality ratings which may have been influenced by their being more likely to have their phone next to the bed ($X^2 = 4.556$, $p = .033$). Compared to non-sleep texting students, those who reported sleep texting were more likely to put the phone in bed with them ($X^2 = 16.850$, $p = .000$). Students who sleep text were also less likely to turn off their phone ($X^2 = 7.492$, $p = .006$) at night or to report feeling that the cell phone influenced their sleep ($X^2 = 3.981$, $p = .046$). Interestingly, it appears that sleep texting students are more likely to know other college students who share the same behavior of sleep texting (52.3% vs.47.7%; $X^2 = 10.956$, $p = .001$) than students who do not sleep text.

Comments

Sleep is increasingly recognized as important to health across the lifespan, with poor sleep quality being linked to unintentional accidents, physical ailments, psychological distress, and chronic health conditions.[1,2] The current study supports findings in the literature and anecdotal evidence that technology, such as smart phones and sleep texting is a growing trend in a college age student population. Key findings from this study are: (1) The majority of students are not reporting quality or length of sleep during the week; (2) Most students do not mute or turn off their cell phone for sleep; (3) A third of the sample reported answering their cell phone when asleep and a quarter of the college students reported sleep texting; (4) Students who sleep text were more likely to report that the cell phone influenced their sleep as well as sleep quality; and (5) The majority of the students who sleep text reported not remembering the behavior or context of the text.

Our findings confirm the typical sleep pattern reported in college students who are partially sleep deprived throughout the week[5,6] and who use the weekends for sleeping.[8–11] Sleep is important at any age, but in a college student population not getting enough sleep may be linked to success in school as sleep disturbance has been consistently rated as a top impediment to academic performance in college.[6,7] For college students who have sleep debt, research suggests that the lack of sleep affects the memory ability needed in learning new material, studying for exams, and test taking skills.[5,6,10] Research on learning suggests that sleep is critical at almost all stages of memory formation, memory processing, and long-term memory retention, which are key aspects linked to academic success.[2,3] Without sleep an individual's brain becomes less effective at absorbing new information and the ability to retain recently learned information is impaired.[1–3]

Findings from the current study suggest that the majority of the sleep texting students had no memory of the texting behavior as well as who or what they texted. The lack of memory is not surprising as sleep research has found that people awakened after sleeping more than a few minutes are usually unable to recall the last few minutes before they fell asleep. This sleep-related form of amnesia is the reason people often forget telephone calls or conversations they've had in the middle of the night.[14] It is interesting to note that the majority of sleep texting students reported having no memory of who or what they sleep texted, but an overwhelming percentage (95%) reported checking their phone histories every morning suggesting that their sleep texting is not a new behavior.

Technology use and the constant monitoring of social media have altered sleep behaviors among traditional-age college students[10] with the Pew Research Center reporting that nearly 24% of teens are online "almost constantly".[15] To a college student whose cell phone is also a data device connecting them to the world, their school, their friends, their professors, as well as family, placing the phone near them when sleeping provides opportunities for technology to interfere with quality sleep.[10,15,16] In our study, one-third of the college students surveyed reported answering their cell phone at night. Answering a call at night is not an unusual occurrence, a recent study reported that 47% of respondents described nighttime waking to answer text messages and 40% to answer phone calls.[16] Communicating during sleep is not an uncommon event. Many persons acknowledge that they talk in their sleep, walk in their sleep, eat in their sleep, or have answered phone calls on their landlines in their sleep with little recollection of having done so the following day. This type of behavior, frequently referred to as the "on call effect," derives from the clinical response of physicians who, awakened by pages, respond, often later having no recollection of their conversations.[14] Too little sleep over time leads to individuals becoming drowsy, anxious, and often unable to concentrate the next day in addition to reports of impaired memory and physical performance.[14] With the phone either in the bed or near the

bed, it is not surprising that being awoken by a phone is another factor that is affecting student quality of sleep.

Young adults are averaging 60–100 texts a day so checking a cell phone multiple times a day has become a common behavior. Thirty-nine percent of individuals over 30 years of age report bringing their cell phones or smart phones into their bedrooms at night. This is in sharp contrast to the 72% of 13–18 year olds and the 67% of 19–29 year olds who report not only having their cell phones in the bedroom but are using them to text in the hour prior to trying to fall asleep.[2,3] In a young adult group 21% have reported that they are texting in the hour prior to falling asleep which indicates that their cell phone remains in the room, frequently in the bed with them.[2] The influence of having a cell phone that provides instant access to almost anyone, anything, and everything has made this hand-held device an integral part of everyday life. The attitude of college students regarding their mobile phone has shifted; the use and proximity of the phone has become habitual to the point where some students seem to have developed a hypervigilance toward their phones. This hypervigilance may be likened to that of a mother, who is able to sleep through many disruptive or loud sounds, but immediately awakens at the sound of her baby's cry. Just as the mother has developed a special sense to hear her baby crying, college students may treat their phone in the same manner.[17] Keeping the phone at a close proximity at all times, including during sleep, and the hypervigilant attitude may cause students to wake for the notifications while sleeping through other stimuli. This hypervigilance is demonstrated during the phenomenon of sleep texting, where the phone notification disrupts sleep, and the student replies, often with no memory of the interaction.

The sleep interruptions created by the hypervigilant attitude toward the phone throughout the night may affect the students sleep quality and length, each notification and response contributing to an overall sleep debt that lengthens each night. This chronic partial sleep deprivation caused by sleep texting contributes to students' fatigue, affecting their decision making as well as their health. One study found that sleep-deprived college students performed significantly worse than peers who had adequate sleep on the cognitive task work and that the sleep-deprived students were not aware of the extent to which sleep deprivation negatively affects their ability to complete cognitive tasks.[11] Sleep duration and obesity have been linked in multiple studies, with greater sleep deprivation associated with an increased obesity risk. Several laboratory studies have shown that short sleep durations over time can result in changes in the regulation of the hormones associated with appetite and satiety.[18]

The effects of insufficient sleep or partial sleep deprivation, are also associated with cognitive problems, mood alterations, reduced job performance, reduced motivation, increased safety risks, and physiological changes.[18] Our study's sample was recruited from two schools of nursing, a profession that carries a high risk of inducing partial sleep deprivation. The length of the shifts, rotating shifts, and working nights all contribute to sleep loss as well as unhealthy sleep patterns. Many American nurses have unusual sleep patterns with some missing, on average, 84 minutes of sleep on work days versus non-work days, and night-shift workers obtain 1–4 less hours when working night shift.[19] There is a growing body of literature looking at understanding how nurse and provider fatigue effects decision making and patient outcomes. Healthcare worker fatigue increases the risk of adverse events, compromises patient safety, and increases risk to personal safety and well-being. For many the missed sleep adds up and evidence suggests that the long shifts, shift rotations between day and night, as well as double shifts, are associated with multiple short- and long- term health and safety risks.[19] Nurses who are fatigued, tired, have a sleep debt, or a lack of time to recover between shifts are more likely than unimpaired nurses to regret clinical decisions.[20] How our sample performed in the clinical settings with patients or in the simulation lab during testing is not known but encouraging the future nursing workforce to increase their understanding of healthy sleep practices, adverse health consequences of impaired sleep is important.

Cell phones are not the only piece of technology that college students use. Attention to other devices such as laptops, iPads, iPods, tablets, electronic book readers, charging devices, and printers must also be evaluated. When measuring amount of sleep during the week compared to the weekend, students with four or more technological devices in their bedroom had significantly less sleep when compared to those with three or fewer devices.[3,10,16] Research has demonstrated that individuals who report excessive use of computers and mobile devices in the bedroom have later bedtimes and tend to sleep later in the morning.[2,3,16] This supports the premise that the reliance on technology, in a place that has been traditionally reserved for sleep, is making it difficult for some

individuals to maintain a separation between their waking and sleeping activities.

Clinical implications

The subject of sleep can be a gateway topic for nurses, providers, health care professionals and educators to address across the lifespan, but especially when working with a young adult, college student population. Providers are in a unique position capable of screening as well as assessing sleep and sleep quality by asking questions directly related to amount of daily sleep, quality of sleep, type of sleeper, any sleep concerns, and the use of technology before or during sleep. By asking questions about sleep, providers and other health professionals can detect poor sleep quality as well as behaviors or problems associated with lack of sleep much in the way that providers screen for health risk behaviors (eg, alcohol use, smoking). During the history taking or interview phase of the assessment questions focused on sleep behaviors can be asked directly. Answers to these questions can provide insight into health promotion, plans of care, and sleep interventions that can be tailored to fit the individual. Teaching young adults and college students how to effectively manage sleep can improve their well-being.[16]

Individuals who report that their sleep quality is directly affected by the cell phone may have difficulty with limits due to a heavy reliance on their phones which may be leading them to not be able to form appropriate boundaries around usage.[3,13,16] Ideally, cell phones should not be in the bed, but on a table, desk, or bureau placed in the room. During sleep time phones can and should be turned to mute, programed to not receive calls, or turned off. If this is not possible, students should be strongly encouraged to use existing phone sleep settings or applications to minimize sound disruption from the phone. They should be reminded that applications, as well as programs, can be useful in helping obtain quality sleep. Healthy sleep habits such as regular bedtimes and wake times, in addition to avoidance of screen-related media in the bedroom should be discussed with young adults. As our understanding of sleep texting behavior increases, health providers can play a supportive-educative role in promoting normal sleep patterns in college students.

Our findings offer empirical support for the association between the sleep texting and sleep quality. On the study's survey multiple students wrote in response to the one open-ended question their views of sleep texting as well as some unique strategies to prevent sleep texting. For example, one student shared her creative solution to sleep texting was to wear mittens to bed every night to prevent the texting since moving "the phone from being in my bed to next to the bed is not an option, I have to keep my phone with me." Another student shared, "I do sleep text sometimes, but I also dream about sleep texting and that's when I check my history. But, it's weird to dream of it and not do it and then not dream of sleep texting only to find out I did do it." One senior wrote, "it surprised me that this (sleep texting) is something you want to study since everyone does it and I guess since it is something we all do why should it be studied…." Further qualitative inquiry of sleep texting can facilitate the understanding of this behavior from the student's perspective and inform the strategies to discourage this behavior among college students.

Limitations

The study findings should be viewed in light of the study limitations. One limitation of the present study is the reliance on retrospective subjective reports as measures of sleep patterns and the behavior of sleep texting. Sleep-wake diaries or sleep study tests measurements such as polysomnography or actigraphy, could possibly provide more valid assessments of sleep than asking a college student to recall their sleep patterns. Although a quarter of the college students reported sleep texting in our sample, this behavior may have been under-estimated as the students may not have been aware of having engaged in this behavior. In addition, there were no data collected specifying the frequency of sleep texting during a night session or when the text(s) occurred during the student's sleep pattern. Also, sleep texting was asked as an overarching question without being specific to nighttime sleeping versus napping, a trait common to college students. Nonetheless, the study's data were well-suited to this initial examination of sleep texting in a young adult, college student sample.

Future research

Our initial investigation of the impact of technology and the phenomenon of sleep texting in college students has suggested this to be a trending practice in this population and provided support for the perceived negative impact of sleep texting on sleep quality. We will continue to investigate this interesting phenomenon. The objective monitoring of polysomnographic changes during sleep together with a

continuous recording of nocturnal behavior via camera in a lab setting may contribute to our understanding of the mechanism of how sleep texting causes arousals from sleep. Qualitative inquiry may facilitate our understanding of social factors contributing to this phenomenon, how students justify or "make sense" of sleep texting, and the perceived benefits of and barriers to discontinuing this behavior.

Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States and received approval from the Institutional Review Board of Villanova University.

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