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The Impact of Media Use on Adolescent Sleep Efficiency

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Abstract

Objective—In 2010, American youth ages 8-18 spent an average of 7½ hours daily using entertainment media, an increase of more than an hour compared to 2005. Increase in media use is associated with multiple negative outcomes, including decreased sleep time and increased tiredness, but little research has examined whether media use is associated with poorer sleep efficiency when the individual is actually asleep.

Methods—This study assessed relationships between adolescent media use and sleep efficiency. Fifty-five adolescents (mean age=14.89 years, SD=0.62; 53% African-American, 47% Caucasian) completed self-report measures concerning their media use. Sleep quality was measured by actigraphy for one week, and both sleep offset and sleep efficiency were extracted from actigraphy data.

Results—Sleep efficiency was negatively correlated to daily time spent text messaging ($r(52)=-0.29$, $p<.05$), media use after bed ($r(52)=-0.32$, $p<.05$), and number of nighttime awakenings by mobile phones ($r(52)=-0.33$, $p<.05$). Decreased sleep efficiency was related to sleeping later in the morning, presumably to make up for lost sleep at night ($r(52)=-0.33$, $p<.05$). In a regression model, media use accounted for 30% of the variance in sleep efficiency (Adj. $R^2=0.30$, $F(6,44)=3.74$, $p<0.01$).

Conclusions—Media use after bed, awakenings by a mobile phone at night and sleep offset associated with adolescents' sleep efficiency. Results support the incorporation of media use habits into adolescent sleep health education and sleep dysfunction interventions. Parental education about the effects of media use on sleep could also mitigate negative effects.

Keywords

Adolescents; sleep; media

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INTRODUCTION

In 2010, American children ages 8-18 spent an average of 7½ hours daily using entertainment media, over an hour more than reported just five years earlier in 2005.[1] In 2012, Norwegian male adolescents reported almost 7 hours of daily media screen time while females reported about 5.5 hours.[2] Although television continues to be a primary source of adolescent entertainment, adolescents are increasingly turning to other sources for their media consumption. For example, in 2013, 93% of American adolescents ages 12-17 owned or had access to a computer, 80% owned a video game console, 78% owned a cell phone (47% of which were smartphones), and 23% owned a tablet.[3] The mobile phone is perhaps the most rapidly advancing form of media. In 2012, American adolescents reported watching about 8 hours of video per month on their mobile phone,[4] and 95% of adolescents reported using the internet, with 25% accessing the internet primarily through their mobile phone. Text messaging through mobile phones offers another domain of entertainment for adolescents; the median number of texts received per day for adolescents ages 14-17 increased from 60 to 100 between 2009 and 2011.[5]

With multiple sources of media available simultaneously to adolescents, researchers have begun examining media multitasking,[1,6-7] defined as the use of more than one media source at a time. Most frequently, multitasking is assessed by tallying the number of hours spent on a single media and therefore counting multitasked hours as multiple hours, such that an adolescent who reports playing on an internet website using their mobile phone for an hour while also watching television would be assigned 2 hours of media use for that hour-long period. However, past measures of media multitasking have not included time spend talking on the cell phone and text messaging. Media multitasking among adolescents has risen dramatically in recent years, increasing from about 8.5 hours in 2004 to almost 11 hours in 2009,[1] and it is associated with symptoms of depression and social anxiety,[8] and with decreased task-switching ability.[9]

Another negative consequence of adolescent media use is its effect on sleep. As media becomes lighter, smaller, wireless and generally more accessible, adolescents are bringing media into their bedrooms. According to the 2014 *Sleep in America Poll*, 75% of children ages 6-17 had at least one media device in their room, including televisions (45%), music players (40%), tablets or smartphones (30%), video game consoles (25%) and computers (21%).[10] Around 80% of adolescent males and over 90% of adolescent females reported using their cell phone within the last hour before bed, and 85% of both male and female adolescents reported using their computer within the last hour before bed.[2] Thus, a large portion of American adolescents have unrestricted and unmonitored access to media use throughout the night. This access might impact adolescents' sleep.

In fact, greater media use has been associated with decreased sleep time and increased tiredness.[11-12] Historically, television viewing was the electronic media most closely associated with decreased total sleep time, prolonged sleep onset latency and delayed bedtime.[13] However, we might presume that trends are changing with new technologies being introduced. For example, recent data suggest adolescents with a gaming computer in

their room go to bed significantly later, report higher levels of sleepiness and experience other sleep problems compared to those who do not have one.[14]

A comparatively older study, published in 2007, found that over 60% of adolescents with a mobile phone reported using their phone after lights out, and those who used their mobile phone more often after bedtime reported being sleepier than those who do not use it after bedtime.[15] Surprisingly, a 2010 literature review found that the impact of mobile phone use on sleep was less clear than with other media.[13] However, each of the studies reviewed was completed using self-report of sleep variables, which may have affected the results.[16] Additionally, over the past 5 years, the introduction of smartphones that offer access to the internet, more efficient text-messaging and video-chatting with friends, and substantial options for interactive and social game-playing, has likely altered the influence of electronic media use on adolescent sleep. In fact, a 2015 publication indicates smartphone ownership among adolescents was related to more electronic media use in bed before sleep and later bedtimes.[17]

Another way media use may influence adolescent sleep is through the alerting effects of bright screens. Circadian rhythm provides organization for the timing of sleep/wake patterns.[18] These patterns oscillate over a period of about 24 hours[19] and are moderated by light. Specifically, as the sun sets and it becomes dark outside, in typical functioning the pineal gland secretes melatonin to decrease alertness and signal sleep.[20] However, exposure to self-luminous tablet displays suppresses melatonin levels.[21] Thus, when it occurs before bed, that exposure significantly prolongs sleep onset, delays the circadian clock, suppresses melatonin, and decreases morning alertness.[22] Additionally, due to frequent aural notifications from mobile phones signaling email, social media alerts and text messages, it is reasonable to suspect mobile phones may also affect adolescents' sleep, including sleep efficiency, by awakening them throughout the night.

The current study aims to update the literature on how electronic media use is associated with adolescent sleep, including sleep efficiency, sleep onset and sleep offset through use of actigraphy, an objective measurement of sleep.

METHOD

Participants

As part of a larger study assessing the effects of sleep restriction on adolescent pedestrian safety,[23] 55 adolescents (mean age=14.89 years, ages 14-15; 52.8% African American, 47.2% Caucasian, 58% female) were recruited by distributing and collecting permission slips at high schools in the Birmingham, Alabama area. Families interested in learning more about joining the study indicated their interest on the permission slip and then were contacted by research staff to initiate the consent process with both adolescents and their parents. Exclusion criteria included physical or mental illnesses that prohibited valid participation in the study (e.g., blindness, intellectual disability) and sleep disorders; no potential participants were excluded. Thirty-six percent of the sample's parents reported a household income at or greater than $80,000, 45% had a household income between $40,000 and $79,999 and 19% had a household income below $40,000. Participants and

their parent were each paid $20 per visit ($40 total per visit). The Institutional Review Board at the University of Alabama at Birmingham approved the study, and all participants and a parent/legal guardian provided signed informed consent.

Media Use Measures

The adolescents completed the Media Use Scale to assess their average daily media use without specifying an exact time period.[24] Items addressed the number of media sources in their bedroom at night, the amount of time adolescents engaged in media after getting into bed, total time spent texting daily and the number of times they were awakened in the night by their phone (e.g. by incoming text messages, notifications, video-chat requests, or phone calls). It also assessed total daily media exposure through media multitasking, which measured all media sources, including text messaging and talking on the cell phone. Internal reliability data were adequate in this sample (Cronbach's alpha = 0.72).

Sleep Measures

Sleep quality and quantity were measured by actigraphy, a noninvasive, objective measure for detecting patterns of movement during the night.[25-26] Specifically, Phillips Respironics MiniMitter Actiwatch-2 devices were used. Data were collected in 1-minute epochs scored using Actiware software version 5.59.0015 (Phillips Respironics, Bend, OR). The default medium sensitivity threshold (40 counts per epoch) was used. Participants were instructed to wear the actigraph on their non-dominant wrist 24-hours per day for 7 consecutive days, removing it only to swim. Previous work demonstrates validity of actigraphy data, with correlations between sleep duration data using actigraphy and sleep duration data using traditional polysomnography being >0.80.[25-26] Only 18.9% of our actigraphy data were lost due to battery failure;[23] other researchers report an average of 28% lost.[27] Participants also completed sleep diaries each day after waking up and before going to bed. These data were used to confirm actigraph data and as backup in cases where the actigraph failed. The sleep diaries included questions including time in which they got into bed, wake time, if they took any naps and if they took off the watch during the day. Concurrent validity between actigraph data and sleep diary data, assessed through Pearson correlation, was high ($r(88)=.96$, $p < 0.001$).

Three measures were extracted from the actigraphy data and supplemented if needed from diary data: sleep onset, sleep offset, and sleep efficiency. Sleep onset refers to the time at which the adolescent fell asleep at night. Sleep offset refers to the time when the adolescent woke up for the day. Both sleep onset and sleep offset were converted to numeric time of day figures (ranging from 0.00-23.99) for analytic purposes. Sleep efficiency refers to the percentage of time the adolescent was asleep between sleep onset and sleep offset.

Analysis Plan

Analyses were conducted in three steps. First, we examined descriptive data for all variables of interest. Second, correlations were computed between sleep variables and media use variables. Third, in order to assess how nighttime media use, mobile phone use and sleep offset affect sleep variables, media use variables and sleep offset were entered as predictors in separate linear regression models predicting sleep efficiency and sleep onset as outcomes.

SPSS Statistics 20 (IBM Corp., Armonk, NY) was used for all analyses, and a significance level of $p < 0.05$ was used. Regression coefficients are presented as standardized (std.) betas.

RESULTS

Table 1 lists descriptive data for demographic characteristics, and Table 2 reports media use and actigraphy data. Adolescents reported total daily exposure through media multitasking that averaged 23.32 hours (SD=17.93) each day. Seventy-five percent of adolescents reported having 4 or more media sources in their home and 20% reported having 3 media sources in their home. Eighty-four percent of adolescents reported using media after going to bed each night, spending an average of 34 minutes using media in bed, and 35% of the sample reported being woken by their cell phone at least once nightly.

Table 3 presents a correlation matrix between all variables of interest. Sleep efficiency was negatively correlated to time spent text messaging daily ($r(52)=-0.29$, $p<.05$), amount of media use after bed ($r(52)=-0.32$, $p<.05$) and number of times adolescents reported being woken by their phone at night ($r(52)=-0.35$, $p<.05$). Decreased sleep efficiency was also related to sleeping later, presumably to make up for lost sleep at night ($r(52)=-0.33$, $p<.05$). Sleep onset was positively correlated with sleep offset ($r(52)=0.52$, $p<.01$), indicating that those who fell asleep later, slept later to make up. Females were more likely to spend time text messaging ($r(52)=0.42$, $p<.01$), use media after bed ($r(52)=0.34$, $p<.05$) and be awakened during the night by media ($r(52)=0.36$, $p<.05$). Additionally, African Americans were more likely to text message ($r(52)=0.55$, $p<.01$), be awakened during the night ($r(52)=0.33$, $p<.05$), and have later sleep onset ($r(52)=0.29$, $p<.05$).

The last step of the data analysis was to assess relationships between sleep efficiency and media use variables and sleep offset and between sleep onset and media use variables and sleep offset. Linear regression models were constructed. Together, media use variables and sleep offset accounted for 21% of the variance in sleep efficiency (Adj. $R^2=0.21$, $F(4,44)=3.93$, $p<0.01$), although no individual variables were significant. For sleep onset, media use variables predicted 33% of the variance (Adj. $R^2=0.33$, $F(4,44)=6.82$, $p<0.01$), and number of phone awakenings ($\beta=-0.43$, $p<0.01$) and sleep offset ($\beta=0.62$, $p<0.01$, Table 4) were significant predictors.

DISCUSSION

Our results produced three notable findings. First, adolescent media use was associated with several aspects of sleep health. Second, mobile phone use was confirmed to be associated with adolescent sleep. Third, our results update adolescent media multitasking behaviors.

Media use was associated with three aspects of adolescent sleep health: sleep efficiency, sleep onset and sleep offset. Specifically, media use variables and sleep offset accounted for 21% of the variability in sleep efficiency and 33% of the variability in sleep onset. Most previous research assessing the relationship between sleep and media use has relied on self-report of sleep duration, sleep onset and offset and daytime sleepiness.[13] Our use of actigraphy extended the literature by gathering objective measures of these variables as well as assessing sleep efficiency. We found that the extent to which sleep onset was associated

with media use varied somewhat by the type of media adolescents reported using at night. Specifically, increased time texting and media use after getting into bed were associated with later sleep onset in bivariate models, consistent with other research.[28,29] It is not surprising that media use after bed was related to later sleep onset since our sample reported using media for an average of 34 minutes at night after getting into bed. However, our research indicated that increased phone awakenings at night were associated with earlier sleep onset in both bivariate and multivariate models, contrary to our hypotheses. This could be because adolescents awakened by their phone at night obtained poorer sleep efficiency, experienced increased daytime sleepiness, and compensated the next evening by falling asleep earlier. Alternatively, it may be that those with earlier sleep onsets were awakened by phone contacts from peers who went to sleep later in the evening.

Another notable study result was that mobile phone use (through time spent text messaging and number of phone awakenings) was significantly associated with both sleep efficiency and sleep onset. Previous results assessing the effects of mobile phone use on sleep have been inconsistent. Some studies report no relationship between sleep-related constructs and mobile phone use, but others report significant associations with total sleep duration and daytime sleepiness.[13,17] The varying results may be due to use of less reliable self-report sleep data in the past or the rapid changes in technology available to adolescents. In our data, which used objective sleep data assessment and contemporary technology, we replicated a previous report[30] that 35% of our participants reported being woken by their cell phones at least once after falling asleep. Both text messaging and number of nighttime phone awakenings were negatively related to sleep efficiency in our sample, , and our results corresponded with previous research[1] that found both females and African American adolescents are more likely to experience increased nighttime awakenings from mobile phones and to spend more time text messaging than male or Caucasian adolescents.

Finally, our study updates adolescent media multitasking behavior. Adolescents in our sample reported almost 24 hours of daily total exposure to media, significantly higher than reported in previous assessments of adolescent media multitasking.[1] This discrepancy is likely explained by two factors. First, there have been cultural shifts over time: technology today is more economical, accessible and powerful, which facilitates increased consumption. Most teenagers now have a cell phone,[3] which provides them with near-constant access to socializing with peers, playing games, engaging with applications, surfing the internet and listening to music.[1] Adolescents are now spending more time text messaging[5] and connecting through social networking.[1] Additionally, television shows that were once only available on a television set at a certain time each week are now available any time of day on a wide range of devices, including mobile phones, tablets and laptops.[1] With more availability of so many media sources, adolescents are continuously able to spend increased amounts of times using media, often simultaneously. Second, there are methodological explanations for our result. Unlike most previous work[1,6-7] our measure of media multitasking included time spent text messaging and talking on the cell phone, both popular adolescent activities.

Implications

Our results have several implications. First, they suggest that inadequate sleep from media use is likely affecting adolescents' daytime functioning in several ways. Early school start times require adolescents to awaken early and prohibit them from postponing sleep offset drastically during the school year, sometimes creating negative consequences. As documented in the literature, inadequate sleep is negatively associated with academic performance, physical health, unintentional injury risk and other aspects of healthy daytime functioning.[23,31-35] Increasing use of media in the late evening and overnight may exacerbate further the negative consequences of inadequate sleep.

Second, our results have implications for parent rules about bedtimes. The *2006 Sleep in America Poll* showed that adolescents with set rules about bedtime sleep on average more than an hour longer than those who do not have set bedtime rules. Additionally, those with set rules about smartphones sleep almost 20 minutes more per night, and those with set rules about television and video games sleep about half an hour more per night. However, only 39% of 12th graders have a set bedtime, and of those 9th-12th graders that have a set bedtime, 71% of them report a bedtime later than 10PM.[36] Parents may not understand the importance of their adolescents' nightly sleep and therefore may not set or enforce appropriate bedtime or media use rules for their adolescents.

Third, the results have implications for education about the negative effects of nighttime media use on sleep and sleep hygiene. Both parents and adolescents may benefit from public health messaging concerning the need for a consistent sleep schedule, healthy ways to use media, and how media use can influence sleep health. Empirical evidence supports the efficacy of such programs. In one study, for example, a school-based sleep health intervention providing sleep hygiene education to Brazilian adolescents improved sleep irregularity and latency.[37]

Strengths of this study include the use of actigraphy to measure adolescents' sleep and a diverse sample. One limitation is that it studied only one developmental stage (14-15 year olds). Another limitation is that media use was measured only through self-report, and the media use measure asked adolescents to report average daily use without specifying a time frame for that use (e.g. average daily use over the last month). Future studies should objectively measure both sleep and media use.

In summary, media use after bed, text messaging, number of phone awakenings at night and sleep offset significantly predicted both adolescents' sleep efficiency and sleep onset at night. This supports the significant effects of electronic media and mobile phone use on adolescents' sleep and the need to incorporate appropriate media use into sleep hygiene education and sleep interventions.

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REFERENCES

1. Rideout, VJ.; Foehr, UG.; Roberts, DF. Generation M2: Media in the lives of 8- to 18-year-olds. A Kaiser Family Foundation Study. Henry J. Kaiser Family Foundation; Menlo Park, CA: 2010.
2. Hysing M, Pallesen S, Stormark KM, et al. Sleep and use of electronic devices in adolescence: results from a large population-based study. BMJ Open. 2015; 5:1–7.
3. Madden, M.; Lenhart, A.; Duggan, M., et al. Teens and Technology 2013. Pew Research Center's Internet & American Life Project; Washington, DC: 2013.
4. Neilsen Company. The teen transition: Adolescents of today, adults of tomorrow. The Neilsen Company; New York, NY: 2013.
5. Lenhart, A. About one in four teens say they own smartphones. Pew Research Center; Washington, DC: 2012. Teens, smartphones, and texting: Texting volume is up while the frequency of voice calling is down..
6. Foehr, UG. Media multitasking among American youth: Prevalence, predictors and pairings. Henry J. Kaiser Family Foundation; Menlo Park, CA: 2006.
7. Roberts DF, Foehr UG. Trends in media use. Future Child. 2008; 18:11–37. [PubMed: 21338004]
8. Becker MW, Alzahabi R, Hopwood CJ. Media multitasking is associated with symptoms of depression and social anxiety. Cyberpsychol Behav Soc Netw. 2013; 16:132–135. [PubMed: 23126438]
9. Ophir E, Nass C, Wagner AD. Cognitive control in media multitaskers. Proc Natl Acad Sci. 2009; 106:15583–15587. [PubMed: 19706386]
10. National Sleep Foundation. 2014 Sleep in America poll: Sleep in the modern family. Arlington, VA: 2014.
11. Li S, Jin X, Wu S, et al. The impact of media use on sleep patterns and sleep disorders among school-aged children in China. Sleep. 2007; 30:361–367. [PubMed: 17425233]
12. Van den Bulck J. Is television bad for your health? Behavior and body image of the adolescent 'Couch Potato'. J Youth Adol. 2000; 29:273–288.
13. Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: A review. Sleep Med. 2010; 11:735–742. [PubMed: 20673649]
14. King DL, Gradisar M, Drummond A, et al. The impact of prolonged violent video-gaming on adolescent sleep: an experimental study. J Sleep Res. 2013; 22:137–143. [PubMed: 23137332]
15. Van den Bulck J. Adolescent use mobile phones for calling and for sending text messages after lights out; Results from a prospective cohort study with a one-year follow-up. Sleep. 2007; 30:1220–1223. [PubMed: 17910394]
16. Wolfson AR, Carskadon MA, Acebo C, et al. Evidence for the validity of a sleep habits survey for adolescents. Sleep. 2003; 26:213–216. [PubMed: 12683482]
17. Lemola S, Perkinson-Gloor N, Brand S. Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. J Youth Adolesc. 2015; 44:405–418. [PubMed: 25204836]
18. Moore RY. The organization of the human circadian timing system. Prog Brain Res. 1992; 93:101–117.
19. Moore RY. Circadian rhythms: Basic neurobiology and clinical applications. Ann Rev Med. 1997; 48:253–266. [PubMed: 9046960]
20. Zeitzer JM, Dijk DJ, Kronauer R, et al. Sensitivity of the human circadian pacemaker to nocturnal light: Melatonin phase resetting and suppression. J Physiol. 2000; 526:695–702. [PubMed: 10922269]
21. Wood B, Rea MS, Plitnick B, Figueiro MG. Light level and duration of exposure determine the impact of self-luminous tablets on melatonin suppression. Appl Ergon. 2013; 44:237–240. [PubMed: 22850476]
22. Chang AM, Aeschback D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. Proc Natl Acad Sci. 2015; 112:1232–1237. [PubMed: 25535358]

23. Davis AL, Avis KT, Schwebel DC. The effects of acute sleep restriction on adolescents' pedestrian safety in a virtual environment. J Adolesc Health. 2013; 53:785–790. [PubMed: 24012066]
24. Davis, AL.; Cox, M.; Avis, K.; Schwebel, DC. Adolescents' media use and its effect on sleep. Poster presented at the annual meeting of the Associated Professional Sleep Societies: Sleep 2012. Boston, MA.: Jun. 2012
25. Ancoli-Israel S, Cole R, Alessi C, et al. The role of actigraphy in the study of sleep and circadian rhythms. Sleep. 2003; 26:342–392. [PubMed: 12749557]
26. Sadeh A, Acebo C. The role of actigraphy in sleep medicine. Sleep Med Rev. 2002; 6:113–124. [PubMed: 12531147]
27. Acebo C, Sadeh A, Seifer R, et al. Estimating sleep patterns with activity monitoring in children and adolescents: How many nights are necessary for reliable measures? Sleep. 1999; 22:95–103. [PubMed: 9989370]
28. Oka Y, Suzuki S, Inoue Y. Bedtime activities, sleep environment, and sleep/wake patterns of Japanese elementary school children. Behav Sleep Med. 2008; 6:220–233. [PubMed: 18853306]
29. Van den Bulck J. Television viewing, computer game playing, and internet use and self-reported time to bed and time out of bed in secondary-school children. Sleep. 2004; 27:101–104. [PubMed: 14998244]
30. Van den Bulck J. Text messaging as a cause of sleep interruption in adolescents, evidence from a cross-sectional study. J Sleep Res. 2003; 12:263. [PubMed: 12941066]
31. Avis KT, Gamble KL, Schwebel DC. Does excessive daytime sleepiness affect children's pedestrian safety? Sleep. 2014; 37:283–287. [PubMed: 24497656]
32. Carskadon MA. Patterns of sleep and sleepiness in adolescents. Pediatrician. 1990; 17:5–12. [PubMed: 2315238]
33. Stallones L, Beseler C, Chen P. Sleep patterns and risk of injury among adolescent farm residents. Am J Prev Med. 2006; 30:300–304. [PubMed: 16530616]
34. Wolfson AR, Carskadon MA. Understanding adolescents' sleep patterns and school performance: A critical appraisal. Sleep Med Rev. 2003; 7:491–506. [PubMed: 15018092]
35. Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. Child Dev. 1998; 69:875–877. [PubMed: 9768476]
36. National Sleep Foundation. 2006 Sleep in America poll. Arlington, VA: 2006. Retrieved from http://sleepfoundation.org/sites/default/files/2014-NSF-Sleep-in-America-poll-summary-of-findings---FINAL-Updated-3-26-14-.pdf
37. de Sousa IC, Araújo JF, de Azevedo, Macêdo CV. The effect of a sleep hygiene education program on the sleep-wake cycle of Brazilian adolescent students. Sleep Biol Rhythms. 2007; 5(4):251–258.

Table 1

Participant demographic characteristics (n=55).

Characteristics		%
Child Gender	Female	58.0
Child Ethnicity	African American	52.8
	Caucasian	47.2
Household Income	Below $40,000	19.0
	$40,000 to $79,999	45.0
	$80,000 or greater	36.0
Type of Media in Bedroom	Mobile phone	84.0
	Television	66.0
	Computer	42.3
	Videogame	18.8
		Mean ± SD
Children's Age (yrs)		14.89 ±0.62

Table 2

Average Sleep and Media Use Data.

Data Source	Variable	Mean ± SD
Actigraph		
	Number of Phone Awakenings at Night (count)	1.18 ± 2.18
	Total Average Daily Media Use (hrs)	23.32 ± 17.90
	Average Daily Time Texting (hrs)	5.52 ± 6.16
	Media Use after Going to Bed (mins)	33.70 ± 40.80
Media Use Scale		
	Sleep Efficiency (%)	94.90 ± 2.70
	Average Week Day Sleep (hrs)	7.63 ± 1.01
	Average Weekend Sleep (hrs)	8.77 ±1.23
	Average Sleep Onset (time of day ranging from 0-23.99)	22.88 ± 1.13
	Average Sleep Offset (time of day ranging from 0-23.99)	6.84 ± 0.62

Table 3

Correlations for Sleep and Media Use Variables (N = 55).

	2	3	4	5	6	7	8	9
1. Age	−0.08	−0.19	0.10	0.03	−0.10	0.5	−0.14	−0.01
2. Gender (Male=1, Female=2)	-	0.31*	0.42**	0.34*	0.36*	−0.11	0.01	0.09
3. Race (Caucasian=1, African-American=2)		-	0.55**	0.15	0.33*	−0.09	0.29*	0.25
4. Daily Texting			-	0.30*	0.40**	−0.29*	0.14	0.22
5. Media Use After Bed				-	0.18	−0.32*	−0.08	0.10
6. # Phone Awakenings					-	−0.35*	−0.17	0.32*
7. Sleep Efficiency						-	0.00	−0.33*
8. Sleep Onset							-	0.52**
9. Sleep Offset								-

* $p < 0.05$

** $p < 0.01$

Table 4

Linear regression results for adolescents' sleep efficiency and sleep onset.

Dependent Variable	**Sleep Efficiency**		**Sleep Onset**	
Predictor	**SE(B)**	**β**	**SE(B)**	**β**
# Phone Awakenings at Night	0.01	−0.17	0.01	−0.43*
Daily Texting	0.01	−0.14	0.01	0.22
Media Use after Bed	0.01	−0.23	0.01	0.14
Sleep Offset	0.23	−0.25	0.09	0.62*

Note.

Adjusted R^2 for Sleep Efficiency = 0.21 ($p<0.01$) and for Sleep Onset = 0.33 ($p<0.01$).

*$p<0.01$.