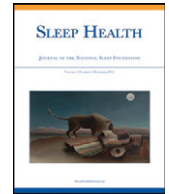




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## Say “GDNT”: frequency of adolescent texting at night

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### ABSTRACT

**Objective:** Electronic media use is pervasive among adolescents. However, prior studies of media use have not specifically focused on texting behavior, and current estimates of teen texting—a primary form of communication among adolescents—are based on teens’ self-reported use. Evaluating the frequency of nighttime texting is crucial, given evidence that such behaviors may contribute to epidemic levels of insufficient sleep among adolescents.

**Methods:** Descriptive analysis of objectively recorded outgoing text message data in a sample of adolescents ( $n = 43$ ; mean = 16.06, SD = 1.29 years of age; 63% females).

**Results:** The current study found that texting behavior was ubiquitous in the pre-bedtime period with 98% of adolescents sending at least 1 text after 8:00 PM. Texting was also very prevalent at night: 70% of participating teens sent at least 1 text between 10:00 PM and 5:59 AM.

**Conclusions:** These findings add to a growing body of literature highlighting the potential role of mobile electronic devices in adolescent sleep disturbances.

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Electronic media use is pervasive among American adolescents, and it has become a fundamental aspect of contemporary adolescent development and communication.<sup>1</sup> Given the rapidly evolving nature of modern day electronic media use and given numerous research and popular press articles documenting the adverse consequences of excessive media use on indicators of adolescent mental and physical health,<sup>2–4</sup> including sleep specifically,<sup>5,6</sup> there has been increasing awareness of the importance of studying the usage prevalence and impact of their use among youth.

Regarding sleep, nighttime media use could contribute to sleep disturbance via exposure to stimulating content, which can lead to hyperarousal in the pre-bedtime period, or via exposure to device-emitted light before bedtime that can disrupt circadian rhythms.<sup>7</sup> Given that adolescence is a period of intense neurobiological, psychosocial, and physical development,<sup>8</sup> it is critical to identify factors, such as electronic media use, which are contributing to the rising rates of sleep disturbance in this vulnerable group.

Several recent studies have examined nighttime media use, broadly defined (which may include television “screen time” as well as screen time from other types of technology, including cell phones), and adolescent sleep.<sup>1,7,9–11</sup> For instance, Hale and Guan<sup>7</sup> found that among the 67 studies identified in a review of the literature on screen time and sleep among children and adolescents, 90% showed a significant inverse association between screen time and

sleep duration. However, of the 67 studies reviewed, only 18 (27%) specifically focused on mobile devices.

Importantly, research suggests that trends in the types of technology being used by adolescents are changing at a rapid rate, with increasing “screen time” related to mobile device use.<sup>9</sup> In particular, the use of “texting” as a means of communication has risen dramatically among teens. For instance, a Pew Research survey<sup>12</sup> found that 63% of all teens say they exchange text messages every day with people in their lives, a rate that far surpasses the frequency with which they pick other forms of daily communication, including phone calling by cell phone (39% do that with others every day), face-to-face socializing outside of school (35%), social network site messaging (29%), instant messaging (22%), talking on landlines (19%), and e-mailing (6%). Such forms of rapid and immediate communication may also directly interfere with adolescents’ sleep, as teens are essentially “available” at all times of the day and night.

Despite the increasing prevalence of mobile phone use among teens and the particular salience for sleep, only a handful of studies have specifically focused on nighttime mobile phone use and the implications for adolescent sleep.<sup>13,14–16</sup> For instance, in a study of Belgian adolescents, 62% of adolescents reported using their cell phones after “lights out,” and such use was associated with significantly increased risk of self-reported “tiredness” 1 year later.<sup>15</sup> Results of a recent meta-analysis suggest that the use of mobile devices is associated with increased sleep disruption and curtailed total sleep time among teenagers; however, the magnitude of the effect is relatively small.<sup>6</sup> The small effect size for the impact of mobile device use on adolescent sleep may reflect the limited

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number of available studies that were included in the meta-analysis ( $n = 3$ ), as well as methodological limitations of the existing studies. Furthermore, few studies have examined texting behavior, specifically in adolescent populations, despite the fact that this is a primary means of communication for this age group, and the specific implications for sleep.

In particular, the extant literature has relied exclusively on self-report methods to measure the frequency and timing of cell phone use. Self-reports are subject to a number of inherent biases, including forgetting and recall bias.<sup>17</sup> Adolescents may also intentionally misreport their texting behavior, for example, if they perceive that it is socially desirable to receive or send more texts because higher use may be considered a sign of status or popularity within this age group. In fact, in a validity study of self-reported texting behavior as compared to phone bill-derived categorical number of outgoing daily text messages among college students (ages 18–24), Gold et al<sup>18</sup> found only 26% agreement between self-reported number of texts and phone bill-derived frequency. Furthermore, there was a systematic tendency to overreport texting frequency; among those who did not accurately report their texting frequency, 81% overestimated.

Recognizing these limitations, this report describes a secondary analysis of data collected from a study in which a smartphone application (“app”) automatically recorded and time-stamped approximately 1 week’s worth of text communications as they occurred in real-time and in teens’ natural environments. Data were collected across the 24-hour period and classified as occurring pre-bedtime (8:00 PM–9:59 PM) and at night (10:00 PM–5:59 AM). We also examined whether texting frequency during each of these time intervals differed according to adolescents’ sex or age.

## Methods

### Design overview

Data are from a study investigating differences in teen communications about health risk behaviors through speech and text messaging. Teens carried a study-issued smartphone and an application (or “app”) on the device recorded the time and content of all outgoing text messages. Participants were required to use the study smartphone to ensure adequate protection of study-related information and standard functioning of the data collection app. (See Gold et al<sup>19</sup> for additional data about the study methods.)

### Sample

Participants were recruited through advertisements in local print media, Web sites ([craigslist.org](http://craigslist.org)), and flyers. Parents or guardians provided screening information on behalf of 62 teens, all of whom were eligible for the study based on the following criteria: adolescents between the ages of 14 and 18 years, with their own cell phones who send text messages at least 4 days per week. Of those invited to participate, 69% ( $n = 43$ ) attended the baseline session and are included in the analytic sample.

### Protocol

Data collection took place from April through September 2013, either during teens’ school spring break or summer vacation. We collected data during these times to circumvent challenges of collecting voice data (collected as part of the parent study) while teens were in school. Parents provided written informed consent, and teens provided assent. All procedures were approved by the RAND Human Subjects Protections Committee.

At the first study session, teens completed a baseline questionnaire (see Measures). Teens then exchanged their own cell phone (stored securely by study staff) for a study smartphone to be used for all calls and texts during the study period. Teens received training on the functionality of the phones and how they should be used. Specifically, teens were told to send/receive all of their text messages (including Twitter) and phone calls using the study phones and that they could use the default applications stored on the phone (ie, select games) as they liked.

After training, researchers transferred all of teens’ contacts from their regular phone to the study phone. Participants then sent a “text blast” (group text) to all selected contacts indicating that they could now be reached by text and by phone at a new number for the study period. Teens then left the study site to use the phones in the field. Teens returned to the study site on the third day of the study to ensure that the app was working as expected and to answer any outstanding questions about the protocol or device. On day 9, teens returned to the study site to return the study equipment, complete a follow-up survey (see Measures section) and semistructured debriefing interview, have their own phones returned, and receive payment. Teens who completed all of the study procedures earned \$180.

### Measures

*Texting data* included only outgoing text messages (including Twitter) so as to avoid collecting data from nonconsented secondary subjects (ie, persons not in the study sending messages to participants). This was a requirement of RAND’s Human Subjects Protections Committee.

*Pre-bedtime texts* were defined as outgoing text messages sent between the hours of 8:00 PM and 9:59 PM each day of the study, averaged within participants, across days.

*Nighttime texts* were defined as outgoing text messages sent between the hours of 10:00 PM and 5:59 AM each day of the study, averaged within participants, across days.

*Total texts* were defined as the number of texts sent by participants in a 24-hour period averaged across the study recording period.

*Demographics* items included age, sex, race and ethnicity, and parental employment and education.

## Results

Participants were 43 adolescents (mean = 16.06; SD = 1.29 years of age; 63% female). Participants were predominantly white (74.19%) and of moderate socioeconomic status (SES): 62% of fathers and 48% of mothers had bachelor’s degrees or more education. Participants’ body mass indices were generally in the reference range (mean = 22.69; SD = 4.36).<sup>20</sup>

On average, texting data were collected for 6.63 days per participant. As shown in the Table, pre-bedtime or nighttime text messaging was ubiquitous: 98% of participants sent at least 1 text after 8:00 PM, and 70% sent a text between 10 PM and 5:59 AM. When asked about how “typical” their texting behavior during the recording period was relative to habitual texting, the majority (71%) said

**Table**  
Texting frequency and distribution over time ( $n = 43$ ).

Texting interval	Mean	SD	Min	Max
Average no. of texts per day over 24-h period	36.50	27.07	3.43	154.71
Average no. of texts pre-bedtime (8 PM to 10 PM per day)	5.73	4.91	0	20.57
Average no. of texts between 10 PM to 6 AM per day	4.44	7.11	0	39.14
Texted at least once over period after 8 PM	0.98	0	0	1.00
Texted at least once over period after 10 PM	0.70	0.46	0	1.00

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