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Original Article

Late use of electronic media and its association with sleep, depression, and suicidality among Korean adolescents

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ABSTRACT

Objective: The aim of this study was to investigate the association of adolescents' last electronic media use time with their sleep and mood disturbances, including depression and suicidality. We also examined whether sleep disturbances and duration mediated the relationship between last media use time and mood disturbances.

Methods: This cross-sectional, school-based, online survey was administered by the Sleep Center at Samsung Medical Center and the Korea Centers for Disease Control and Prevention (KCDC) in 2011. A total of 26,395 participants (12,593 male and 13,802 female) were recruited from 150 middle and high schools representative of nationwide adolescents from 15 administrative districts in Korea. The sleep habits of participants on weekdays and weekends were evaluated using a questionnaire. Sleep disturbances, depression, and suicidality were assessed using the Korean versions of the Global Sleep Assessment Questionnaire, Epworth Sleepiness Scale, and Beck 19-item Scale for Suicide Ideation. We also collected last media use time, from which we subtracted actual bedtime.

Results: Late electronic media use was significantly associated with increased mood disturbances including depression and suicidality directly, but not indirectly via sleep duration or disturbances.

Conclusion: Our results suggest that adolescents might benefit from the restricted use of electronic media after bedtime in terms of their mood and sleep. Moreover, education regarding media use at night might be helpful in preventing youth suicide.

1. Introduction

Electronic media use has become prevalent worldwide, particularly among adolescents. As electronic media, such as mobile phones, video game consoles, digital versatile/video disk (DVD) players, television, audio players, computers, and tablets, become more lightweight and portable, these media have become a substantial part of everyday life, with virtually no limits on the time or place of their use. Accordingly, the presence of electronic media in the bedroom and their use at night have been increasing [1]. Adolescence is a critical transitional period for physical, cognitive, and psychosocial development [2]. Adolescents are subject to large changes in sleep patterns and insufficient sleep resulting from the interaction of extrinsic (eg, school start times, activities, and academic and social demands) and physiologic (eg, developmental changes in puberty) factors [3]. Moreover, adolescence is characterized by an increasing vulnerability to mental health problems. It has been reported that 20% of adolescents experience depressive symptoms by the age of 18 years [4], and almost one-half of recovered adolescents have a recurrence within five years [5]. Moreover, suicide, which is the most extreme adverse effect related to depression [6], constitutes a major public health problem in Korea, which has the highest suicide rate among the member countries of the Organization for Economic Cooperation and Development [7].

Given the probability of developing sleep and mental health problems during adolescence, previous studies have examined the negative impact of electronic media on sleep and mood. High use of electronic media is known to be associated with poor sleep quality

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(including long sleep latency and more night waking), short sleep duration, and mood disturbances, including depression, anxiety, and suicidality, with different results according to the study designs and types of electronic media examined [8]. Despite the interrelated characteristics of mood and sleep problems [9], to the best of our knowledge, there are only three small studies that reported on the complex relationship between electronic media use as well as sleep and mood problems [9–11]. These studies examined the mediating role of sleep disturbances on the relationship between the amount of time spent using electronic media and developing depression or anxiety. In terms of suicidality, two studies discussed the association between mobile phone use and suicidality in the analysis, without considering the interrelationship with sleep [12,13].

Considering the increased prevalence and availability of electronic media, the temporal relationship between last media use time and actual bedtime, rather than the total use time of media, may be a more suitable target to analyze for its association with sleep problems. Moreover, if it is determined that last electronic media use time relative to bedtime affects sleep and mood, then this extrinsic factor can be modified to improve sleep and mental health in adolescents.

Therefore, the aim of this study was to investigate the association between the time of last electronic media use (not the total duration of electronic media use), with sleep and mood disturbances, including depression and suicidality among adolescents. Our hypothesis was that later use of electronic media is associated with increased depression and suicidality. On the basis of this relationship, we further hypothesized that sleep disturbances (insomnia) and duration mediate the associations between electronic media use time and mood disturbances.

2. Methods

2.1. Study population

This cross-sectional, school-based, online survey was administered by the Sleep Center at Samsung Medical Center and the Korea Centers for Disease Control and Prevention (KCDC) in 2011. A total of 26,395 participants were recruited from 150 middle and high schools (7th–12th school grades) from 15 administrative districts (metropolis/province) in Korea, representative of nationwide adolescents; all administrative districts except Jeju Island (province) were included. We used a stratified, two-stage cluster sampling. A total of 75 middle schools and 75 high schools were selected nationwide (first stage), and two classes from each grade within each chosen school were sampled (second stage). Students who gave their consent to participate in this study filled out online questionnaires. Excluding 1719 observations (6.5% of the original sample of 26,395) with missing or unreliable data (eg, 0 or $\geq$24 hours for sleep duration), the final sample for this study included 24,676 complete cases. This study protocol was approved by the Institutional Review Board of Samsung Medical Center.

2.2. Measures

Participants were directed to a website where, on the home page, they were provided with a video clip and instructions on taking the survey. They were then asked to fill out a questionnaire self-reporting their sleep habits, sleep disturbances, daytime sleepiness, depressive symptoms, and suicidal feelings and attempts.

2.3. Sleep-related variables and demographics

The questions related to sleep habits, including sleep duration, bedtime, and wake time on weekdays and weekends, were as follows: (1) “During this calendar year, how many hours on average have you usually slept each weeknight?” (2) “On average, when do you usually go to bed on weeknights?” and (3) “On average, when do you usually wake up on weekdays?” Similar questions were also used for weekends. Desired sleep duration was asked in the question: “How long is the desired sleep needed for daytime activity without sleepiness or fatigue?” Demographic variables included sex, school grade, body mass index (BMI, calculated from body weight and height), number of private educational institutions (except public government education), and time spent in a private educational institution.

2.4. Sleep disturbances

The Global Sleep Assessment Questionnaire (GSAQ) is a self-administered screening tool to screen for and differentiate among the following six sleep disturbances: insomnia disorders, obstructive sleep apnea syndrome, restless legs syndrome (RLS), periodic limb movement disorder (PLMD), parasomnia, and insomnia associated with a mental disorder [14]. We used the first section of the Korean version of the GSAQ, which contained 11 items having consistent four-item response options (eg, “never,” “sometimes,” “usually,” “always”), and we considered “usually” and “always” as the affirmative answers to the question. In the GSAQ questions, question 1 was used to assess symptoms of sleep disturbances (insomnia) as a dependent variable: “Over the past four weeks did you have difficulty falling asleep, staying asleep, or feeling poorly rested in the morning?”

2.5. Daytime sleepiness

The Korean version of the Epworth Sleepiness Scale (ESS) was used as an additional subjective measure of daytime sleepiness [15]. Respondents were instructed to score their general tendency to fall asleep or doze off in each of eight situations, on a four-point Likert scale ranging from 0 (no chance) to 3 (strong chance). The last item of the ESS questionnaire was originally for a driver: “In a car, while stopped for a few minutes in the traffic,” was modified to a question for a passenger, because persons younger than 20 years old are not allowed to drive in Korea. Possible ESS scores ranged from 0 to 24, and higher scores represented a greater propensity for sleepiness in the daytime. Cronbach’s α was 0.90.

2.6. Depression

Depressive symptoms were measured using the Korean version of the Beck Depression Inventory (BDI) [16,17], which is the most commonly used self-rating scale for depression. Patients answered 21 items on a scale of 0–3 according to how they felt at the time. Higher scores reflected higher levels of depressive symptoms. Cronbach’s α was 0.8.

2.7. Suicidality

The Korean version of the Beck 19-item Scale for Suicide Ideation (SSI-Beck) was assessed to measure the severity of suicidality [18,19]. Patients answered 19 items on a scale of 0–2. Higher scores indicated higher risk of suicide, with the total score ranging from 0 to 38. Cronbach’s α was 0.87.

2.8. Electronic media-related variables

The questions about media use were: “Do you use electronic media before sleep?” and “When do you end the use of media (television including mobile-based digital multimedia broadcasting