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Longitudinal associations between time spent using technology and sleep duration among adolescents☆

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ABSTRACT

Technology use has been the focus of much concern for adolescents' sleep health. However, few studies have investigated the bidirectional association between sleep duration and time spent using technology. The aim of this study was to test whether time spent using technology predicted shorter sleep duration, and/or vice versa using cross-lagged analyses over one year. Participants were 1620 high school students in the 8th and 9th grade at baseline from 17 public schools in three middle Sweden communities. Students completed questionnaires at school during the spring of 2015 and 2016. Time spent using technology was self-reported and sleep duration was calculated from reported bed-times, wake-times and sleep onset latency. Time spent using technology significantly predicted shorter subsequent sleep duration and vice versa. Public health advocates educating others about the negative impacts of technology on sleep must also be mindful of the opposite, that many young people may turn to technological devices when experiencing difficulty sleeping.

1. Introduction

Sleep issues and technology use have important implications for the health and wellbeing of adolescents. Insufficient sleep quantity has been found to be negatively related to multiple areas of adolescent development and adjustment, including physical health, learning and school attendance, and emotion regulation (Bauducco, Tillfors, Özdemir, Flink, & Linton, 2015; Shochat, Cohen-Zion, & Tzischinsky, 2014). Similarly increased time using technology has been linked to decreased academic performance and less personal contentment among adolescents (Rideout, Foehr, & Roberts, 2010).

Over the last 10–20 years, developments in a fast-paced modern lifestyle has seen the sleep quantity of adolescents decline (Keyes, Maslowsky, Hamilton, & Schulenberg, 2015). This is noteworthy, since adolescence is a sensitive period for sleep where many biological and psychosocial changes occur that may lead to difficulties falling asleep and insufficient sleep duration (Becker, Langberg, & Byars, 2015). According to the National Sleep Foundation, adolescents require 8–10 h sleep per night, which is more than the amount required by adults as developmental requirements for sufficient sleep decrease in duration across the lifespan (Hirshkowitz et al., 2015).

Many argue that the advances in technology, including 24/7 access to the internet and social media, have played a substantial role in the reduction of sleep duration (Keyes et al., 2015; Kronholm et al., 2015; Matricciani, Olds, & Petkov, 2012). Unquestionably, rapid advances in technology are changing how and how often young people interact with technology and utilise of devices. Bucksch et al. (2016), in a cross-cultural study, found that adolescents spent more time using technology in 2010 as compared to 2002.

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Similarly, in the USA, adolescents average time spent using technology increased from 6 and a half hours in 2004, to more than 7 and a half hours in 2009 (Rideout et al., 2010). More than 90% of adolescents (age 11–17) both in Sweden and USA now have access to at least one technological device and are spending an increasing amount of time using such devices (Medierråd, 2015; National Sleep Foundation, 2006).

A negative association between technology use and sleep duration has consistently been reported in relation to children and adolescents (for a review and meta-analysis, see Bartel, Gradisar, & Williamson, 2015; Hale & Guan, 2015). Increased time using technology is associated with an elevated risk of shorter sleep duration and other sleep problems (for a review see Bartel & Gradisar, 2017). Technology might disrupt sleep by suppressing the night-time hormone melatonin, and thus eliciting alertness at bedtime, by provoking cognitive and emotional arousal, or by simply displacing time from sleep (Bartel & Gradisar, 2017; Cain & Gradisar, 2010). Although most research has focussed on the influence technology use has on sleep duration, the opposite association may also be true. That is, adolescents who have trouble sleeping might use technology more often, either to supress boredom and occupy the time spent awake of an evening and throughout the night, or perhaps tired adolescents prefer to engage in sedentary and less demanding activities, such as technology use throughout the day (Garaulet et al., 2011). A third explanation, as reported by (Eggermont & Van den Bulck, 2006) may be due to it being common practice for adolescents to use a variety of technological devices— including television, computer games and listening to music—as sleep aids, which was associated with shorter sleep duration and self-reported tiredness at varying times throughout the day in that study. Additionally, children have been found to obtain more sleep when parents limit their time spent using technology (Pieters et al., 2014; Smith, Gradisar, King, & Short, 2017; Sormunen, Turunen, & Tossavainen, 2016).

Few studies have employed a longitudinal design to enable examination of the potential bidirectional associations between sleep duration and time using technology among adolescents. Furthermore, the findings amongst these sparse studies have been mixed. Johnson, Cohen, Kasen, First, and Brook (2004) in a longitudinal study of adolescents into early adulthood found the amount of technology use predicted sleep duration, but that sleep duration did not predict amount of technology use. Similarly, Tavernier and Willoughby (2014), contrary to their hypotheses, found sleep duration was not be associated longitudinally with time spent using technology (including TV viewing and online social networking) in emerging adults (17–25 years). On the other hand, Barlett, Gentile, Barlett, Eisenmann, and Walsh (2012) found sleep duration was inversely associated with subsequent TV watching. Finally, whilst explored on a child sample, Magee, Lee, and Vella (2014) found bidirectional associations between sleep duration and time spent using technology (specifically, TV).

Given the many consequences of insufficient sleep duration and the increasing time spent using technological devices, it is crucial to elucidate how sleep and technology interact with each other in this developmental period. Both sides of this relationship must be explored; not only is it important to expand knowledge on the impact of time spent using technology on sleep duration, but also to highlight that the reverse relationship whereby young people may turn to technological devices when experiencing difficulty sleeping.

The aim of this study was to explore the strength and direction of relationship between sleep duration and time spent using technology over a year period. Specifically, the study will investigate whether adolescents in a normal population who use technology more are at risk for insufficient sleep duration and/or whether adolescents who report short sleep duration are more likely to engage in increased time spent using technology one year later. It was hypothesized that sleep duration and time spent using technology would have a reciprocal relationship, whereby sleep duration predicts future time spent using technology, and time spent using technology also predicts future sleep duration.

2. Method

2.1. Design

Data from two waves (2015 & 2016) of a five-year longitudinal study (2014–18) of Swedish adolescents were used. Note, data from the initial wave, collected in 2014, were not analysed in this paper due to changes in measurement items between this and the subsequent waves of data collection. Two school grade cohorts were included in the sample, being students in Grade 7 & Grade 8 in 2014 at the commencement of the study. Annual measurements followed participants from the upper levels of secondary school (‘högstadiet’) through to high school (‘gymnasiet’).

2.2. Participants

Participants were 1620 adolescents attending one of 17 public schools across three towns of central Sweden (Örebro [12 schools]; Köping [3 schools]; Karlskoga [3 schools]). Just over half of all participants were female (51.9%, n = 841), and 48.1% were male (n = 779). Most were born in Sweden (91.8%) and lived with both parents (73.2%). Two cohorts of participants were included in the sample: Cohort 1 were 954 participants (52.5% females, 47.5% males) in Grade 8 at Time 1 of data collection reported in this paper and Grade 9 for Time 2 measurement; Cohort 2 were 666 participants (51.1% females, 48.9% males) in Grade 9 at Time 1 and Grade 10 (‘gymnasiet’) at Time 2.

2.3. Procedure

Research secretaries and trained test leaders attended schools in central Sweden once per year from 2014, during the Spring term,