



## CLINICAL REVIEW

## Screen time and sleep among school-aged children and adolescents: A systematic literature review



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## ARTICLE INFO

## Article history:

Received 11 June 2014

Received in revised form

20 July 2014

Accepted 29 July 2014

Available online 12 August 2014

## Keywords:

Sleep

Sleep duration

Total sleep time

Screen time

Media

Electronic media

Video games

Children and adolescents

## SUMMARY

We systematically examined and updated the scientific literature on the association between screen time (e.g., television, computers, video games, and mobile devices) and sleep outcomes among school-aged children and adolescents. We reviewed 67 studies published from 1999 to early 2014. We found that screen time is adversely associated with sleep outcomes (primarily shortened duration and delayed timing) in 90% of studies. Some of the results varied by type of screen exposure, age of participant, gender, and day of the week. While the evidence regarding the association between screen time and sleep is consistent, we discuss limitations of the current studies: 1) causal association not confirmed; 2) measurement error (of both screen time exposure and sleep measures); 3) limited data on simultaneous use of multiple screens, characteristics and content of screens used. Youth should be advised to limit or reduce screen time exposure, especially before or during bedtime hours to minimize any harmful effects of screen time on sleep and well-being. Future research should better account for the methodological limitations of the extant studies, and seek to better understand the magnitude and mechanisms of the association. These steps will help the development and implementation of policies or interventions related to screen time among youth.

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## Introduction

Insufficient sleep, delayed sleep-wake behavior, and sleep disturbances are common among youth and adolescents around the world [1]. For example, the 2011 Sleep in America Poll [2] reported that about 60% of adolescents in the United States (US) receive less than eight hours of sleep on school nights, which has increased from 45% in the 2006 Sleep in America Poll [3]. In addition, 77% of adolescents reported having sleep problems, with waking up feeling un-refreshed (59%) and difficulty falling asleep (42%) most commonly reported [2].

A review article [4] describes how delays in bedtime among youth as they get older can be attributed to biological, psychosocial, and environmental causes. One of these environmental sources is the use of screen-based activities that often delay bedtime or truncate total sleep time (TST). Nearly all US adolescents (97%) have at least one electronic item (e.g., television, computer, mobile phone, video game console) in their bedroom [3]. With the ubiquitous presence of media items in an adolescent's bedroom, screen time is hypothesized to be a cause of insufficient and low quality sleep [5], operating through several mechanisms [5,6]. The first is

time displacement – with more time spent in front of screens, youth have less time available to sleep. Second, psychological and physiological arousal due to the content of the media [7] and social interaction may also interfere with the ability to fall and stay asleep. And finally, there is the effect of light on both circadian rhythm and alertness. The effect on circadian rhythm is mediated through physiological suppression of the sleep-promoting hormone melatonin through the bright light from screens [8] and in the bedroom [9]. A recent study found that self-luminous tablets (Apple iPads set to full brightness) caused statistically significant melatonin suppression after two hours of use, but not from only one hour [10]. Additional research has shown that light has an acute alerting effect in which the dose, exposure duration, timing and wavelength of light evokes an alerting response among humans [11].

Electronic media pervade modern life. In the US, school-aged children and adolescents spend around 7 h per day in front of a screen [12,13]. The consequences of excessive screen time on general health, physical activity, cognitive and social development have been addressed by numerous scholars [14–17]. The effects of screen time on sleep patterns and sleep quality are also actively being studied by researchers around the world, but these findings have not been compiled in a systematic literature review in over four years [5]. In this review, we concisely update the only known prior systematic literature review that summarized the literature on the

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associations between screen time exposure and a range of sleep outcomes [5]. Further we highlight limitations of the current studies, leading us to conclude with recommendations for further research.

**Methods**

We performed a systematic literature search in Web of Science for original scientific research publications about screen time and sleep. We used the following keywords to conduct our search “screen time AND sleep,” “media AND sleep,” “computer AND sleep,” “phone AND sleep,” “television AND sleep,” and “video game AND sleep.” On February, 24, 2014, 557 abstracts were returned. All were reviewed as to whether they met the inclusion/exclusion criteria discussed below. Additional searches in PubMed, Google Scholar, and various journals identified articles not duplicated in the original search. We also examined the cited literature in the included articles, and contacted three sleep experts to identify any missing articles. Two of the three experts responded and helped us identify nine additional articles. Based on these sources and after exclusions described below, the total number of original research articles included in the study is 67 [18–84]. Fig. 1 provides a flow chart of the studies included.

*Inclusion and exclusion criteria*

We include all studies that investigate the association between any type of screen time and any of the following sleep outcomes: sleep timing, sleep duration, sleep quality, sleep onset latency (SOL), subjective assessment of daytime tiredness or daytime

sleepiness, or other reported outcomes including subjective assessment of insomnia symptoms. In order to be consistent with the prior literature review [5], we narrowed the articles down to include any study that contained participants that were primarily between five and 17 years old. We did not limit the population to any geographical area or gender. When data from the same cohort were presented in more than one study, we included only the most relevant article. We divided studies into type of media included (e.g., television, computer, mobile phone, video gaming device), allowing each study to be categorized in more than one media type, if appropriate.

This project updates a 2010 literature review [5] that used similar inclusion criteria. In the four years since publication of that paper, we found 31 additional articles meeting the inclusion criteria. All articles that fit the above criteria, including those in the 2010 review, are included in this review (See Table 1).

**Results**

Table 1 provides an overview of the first author, publication year, and basic characteristics of all 67 articles included. Studies represent populations from around the world – most studies include samples from only one country and four studies cover multiple European countries at once. Over 40% (27 studies) of the samples used European populations. Twenty-one percent (14 studies) used US samples, 10% (seven studies) used Japanese samples, and 7% (five studies) relied upon Australian samples. The remaining studies included participants from Brazil, Canada, China, Israel, New Zealand, Saudi Arabia, and Taiwan.

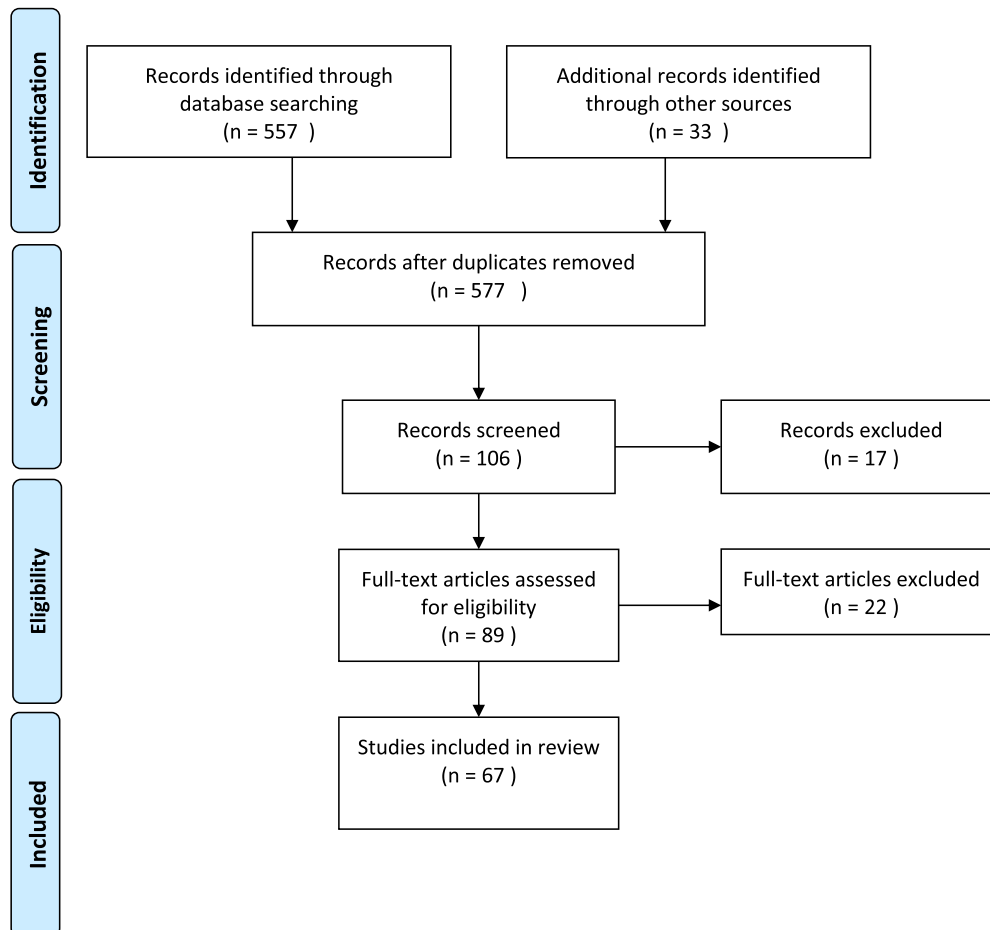


Fig. 1. Flow diagram.

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