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Television use and its effects on sleep in early childhood

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Abstract

Objectives: The purpose of this study was to investigate the impacts of television (TV) viewing and bedroom TV presence on young children's sleep as measured by actigraphy.

Design: Analyses of covariance were run to examine differences in sleep duration and quality among children based on the presence of TVs in their bedrooms and the amount of TV watched.

Setting: Recruited in preschools in Massachusetts; recorded ambulatory (in home, environs).

Participants: Participants were 470 children between 33 and 71 months of age (M = 51.02).

Measurements: Children were instructed to wear an actigraph watch for 16-days. Caregivers reported demographic information, completed behavior questionnaires, and answered questions regarding their child's TV use.

Results: Children who watched more TV and had TVs in their bedroom displayed significantly shorter sleep duration and worse sleep, but they also napped significantly longer in the daytime. Nonetheless, total 24-hour sleep was shorter for those who watched more TV and had TVs in their bedroom compared to those who did not have TVs in their bedrooms or watch TV frequently. Children who had TVs in their bedrooms watched TV later at night, watched more adult TV programs, and had higher negative affect than children without TVs in their bedrooms.

Conclusions: These findings suggest that TV use in young children does impact sleep duration and quality as measured by actigraphy, and daytime napping does not offset these negative impacts.

Keywords

sleep; early childhood; television; actigraphy

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Introduction

Even with the prevalence of mobile technologies, television (TV) accounts for about 42% of daily screen time among children 0–8 years (Rideout, 2017). TV exposure in children has been linked with parent-reported shorter sleep duration as well as sleep terrors, nightmares, and daytime tiredness (Brockmann et al., 2016). It is critical to understand the connection between sleep and TV access, especially in young children. Research on TV exposure has primarily examined adults and school-age children. Less is known of TV use and sleep in early childhood. Thus, the current study examined effects of TV on young children's sleep at night and during daytime naps using actigraphy as an objective measure of sleep.

TV viewing and sleep

The American Academy of Pediatrics recommends that children should be limited to 2 hours of TV per day and children under 2 years should not watch any television (Strasburger, 2010). Watching more TV and watching TV at a very young age has been associated with negative effects on cognitive development (Mistry, Minkovitz, Strobino, & Borzekowski, 2007; Nathanson, Aladé, Sharp, Rasmussen, & Christy, 2014; Zimmerman & Christakis, 2005).

Extended TV viewing has been associated with negative impacts on sleep. From a study of children 4–7 years, Cespedes et al. (2014) reported that each hour of TV was associated with a 7 minute decrease in nighttime sleep duration. A recent study of children from 6 months to 17 years of age revealed only a modest effect of digital screen use (e.g., TV, computer, cell phones), such that each additional hour of use was associated with 3–8 fewer minutes of overnight sleep (Przybylski, 2018). Timing of TV viewing is also particularly important. Children who watch TV after 7 p.m. display more bedtime resistance, more anxiety around sleep, shorter sleep duration, and longer sleep onset compared to children who only watch TV during the day (Cain & Gradisar, 2010; Calamaro et al., 2011). Sleep difficulties have been observed after children watched TV alone, watched TV at bedtime, and watched adult programs (Paavonen, Pennonen, Roine, Valkonen, & Lahikainen, 2006).

Some hypotheses regarding the mechanism by which TV disturbs sleep are primarily based on the premise that TV viewing occurs immediately before bedtime. One explanation is that time viewing TV displaces time sleeping, thus individuals do not get an adequate amount of sleep (Foley et al., 2013; Orzech, Grandner, Roane, & Carskadon, 2016). TV viewing also mat increase mental and emotional arousal (Cespedes et al., 2014; Nathanson & Fries, 2014; Orzech et al., 2016). The increases might not abate before the person goes to bed, thus impacting sleep onset and quality. Finally, light emitted by the TV might delay melatonin release and disrupts circadian rhythms, impacting biological processes which govern sleep (Brockmann et al., 2016; Calamaro et al., 2011). Given that these hypotheses suggest a greater impact of TV immediately prior to sleep onset, it is important to consider the presence of TVs in children's bedrooms (Brockmann et al., 2016).

Bedroom TVs

The American Academy of Pediatrics also recommends that children not have TVs in their bedrooms (Strasburger, 2010). Nonetheless, 29% of children between the ages 0 and 8 years have TVs in their bedrooms (Rideout, 2017), and parents often report the main reason is to help the child fall asleep. Yet, based on parent-reported sleep, children with TVs in their bedrooms experience more sleep problems and sleep 9 minutes fewer during the night than children without TVs in their bedrooms (Brockmann et al., 2016; Cain & Gradisar, 2010; Cespedes et al., 2014; Garrison et al., 2010).

Children with TVs in their bedrooms spend 40–90 minutes more watching TV than children without TVs in their bedrooms (Sisson, Broyles, Newton, Baker, & Chernausek, 2010). Children with TVs in their bedrooms also watch more violent TV programs (Garrison et al., 2010). In addition, the presence of TVs in bedrooms is more common for children in low-income households (Borghese et al., 2015).

The current study

The current study examined the effects of TV viewing duration as well as the presence of TVs in the bedroom on young children's (33–71 months) sleep. Of the scant literature on TV use and sleep at this age, studies have relied on parent-reported measures of sleep. Importantly, we remove parent misperceptions by utilizing actigraphic measures of sleep (Sadeh, Sharkey, & Carskadon, 1994). Actigraphy measures are more accurate because parents tend to overestimate sleep duration (Brockmann et al., 2016). In addition, we collected data about daytime naps as well as the TV programs children watch. We also considered factors which might contribute to the presence of TV in the bedroom, such as mother education, family income, and child temperament. We hypothesized that children's sleep duration and quality would be reduced by TV viewing and TV presence in the bedroom. We also hypothesized that children with TVs in their bedrooms would watch more adult-directed content than children without TVs in their bedrooms. Finally, we considered the hypothesis that children with difficult temperaments would have TVs in their bedrooms for the perceived benefit of aiding sleep onset.

Participants and methods

Children were recruited from preschools in western Massachusetts for a larger study of young children's sleep and cognition. To be eligible, children had to meet the following criteria: enrolled in a participating preschool (eligible age for preschool 33–71 months old); (2) normal or corrected vision and hearing; (3) no history of sleep disorder or developmental disability diagnoses; (4) no use of sleep-affecting or psychotropic mediations; (5) no travel outside of local time zone in the week prior to study start date. The transition from napping to no longer napping is quite heterogenous, occurring across the preschool years (Weissbluth, 1995), thus justifying the 33 to 71 months age range.

Measures

Actigraphy.—Actigraphy provides a reliable estimate of sleep compared to polysomnography (Sadeh et al., 1994) and is deemed valid in this age range compared to

polysomnography (Meltzer, Walsh, & Peightal, 2015) and videosomnography (Sitnick, Goodlin-Jones, & Anders, 2008). The Actiwatch Spectrum 2 (Phillips Respironics, Bend, OR) is a wrist-worn device, is water-resistant, has off-wrist detection, an event marker button, and a triaxial accelerometer to measure motion. The sampling rate was 32 Hz with a sensitivity of <.01g. Data were stored in the internal memory of the watch in 15-second epochs and were downloaded to a computer for analysis after the 16-day study. Caregivers and classroom teachers were also provided with a sleep diary to record the children's daily sleep habits as well as instances when the actigraph was removed. This information aided scoring of actigraphy data. For daily sleep habits, caregivers were asked to record nap occurrences, bedtimes, length of time to fall asleep after bedtime, and wake times. Classroom teachers were asked to record whether children napped during the days of the study.

Actigraphy data were scored using the default algorithm in the Actiware software. Both sleep diary entries and event markers were used to score sleep records. If there was not an entry in the sleep diary or an event marker, the first 3 consecutive minutes of sleep defined sleep onset and the last 5 consecutive minutes of sleep defined wake onset. Research assistants analyzing the data were blind to the conditions and the variables of interest in this study. When sources were discrepant, consensus discussions was used. If consensus could not be reached, data was excluded.

Sleep variables were derived from sleep episodes during day (i.e., naps) and night. These variables were averaged, excluding the day on which a nap was experimentally promoted (see Spencer et al., 2016). Sleep variables in the current analysis included: (1) 24-hour sleep duration, nap/daytime sleep duration, (3) overnight sleep duration, (4) sleep onset time, and (5) wake onset time. Analyses controlled for age.

Researchers asked parents and caregivers to encourage children to wear the Actiwatch as often as possible. Five or more days of usable actigraphy data is a recommended minimum for recording sleep in children (Acebo et al., 1999). However, children with at least 2 days of usable actigraphy data were included in these analyses because those children with 2 to 5 days of actigraphy data accounted for only 5% of the dataset and the mean number of days of actigraphy data was substantially longer than recommended: 11.39 days ($SD = 3.56$). The number of usable days of actigraphy data did not differ across TV viewing groups (Fs < .58, ps > .560). The number of usable days of actigraphy data did differ between children with a TV in their bedroom ($M = 10.68$, $SD = 3.50$) and children without a TV in their bedroom ($M = 11.94$, $SD = 3.39$; $t(280) = -2.89$, $p = .004$).

Demographics and health questionnaire.—The demographics and health questionnaire consisted of 72 questions about both the child and the caregiver. Questions focused on child's health, eating habits, TV use, caregiver education, employment, and income. Children's TV use, mother's education, family income, and other demographic responses were used to characterize the population. TV use related questions included in these analyses were: "Is there a TV in your child's bedroom? If yes, what is the purpose of the TV in the bedroom?", "In the past month, on average, about how many hours a day does your child spend sitting still watching TV or videos?", "Thinking about the past month, on

average, how often does your child watch each of the following programs?", and "If your child watches TV or videos, on average, how long are they away from TV before bedtime?".

Child Behavior Questionnaire.—An abbreviated form (36 items) of the Child Behavior Questionnaire (CBQ-Very Short Form; Putnam & Rothbart, 2006) was used to assess child temperament. Caregivers used a 7-point Likert scale to rate how true each statement of behavior was of their child in the past 6 months. The scale ranged from 1 ("extremely not true") to 7 ("extremely true"), or caregivers could also choose "not applicable" if the statement did not apply to their child. The raw score for the negative affect scale was used for analyses, and this scale is a composite of questions which measure displays of fear, discomfort, anger, and sadness (Rothbart, Ahadi, Hershey, & Fisher, 2001).

Procedure

The Institutional Review Board at University of Massachusetts Amherst approved all procedures of the study. Study information was provided to caregivers at morning 'drop-off' and afternoon 'pick-up'. Experimenters were present to answer questions and collect signed consent forms over the course of a week prior to testing. Caregivers were informed of the study's procedures and provided informed consent. Children also provided assent before participating. On the first day of the study, children had actigraphs fitted to their non-dominant wrists. Caregivers were asked to remind and encourage their children to keep the actigraph on for the 16-day study. In addition, caregivers and children were instructed to press the event marker button on the actigraph at the beginning and end of each sleep opportunity, both during the day and at night. Parents and teachers were also given sleep diaries to complete.

As part of the larger study, during the 16-day interval, experimenters intermittently visited the classrooms to conduct tests of memory (e.g., Desrochers, Kurdziel, & Spencer, 2016; Kurdziel et al., 2013; Kurdziel & Spencer, 2018) and vocabulary (Peabody Picture Vocabulary Test–IV; Dunn & Dunn, 2007). Experimenters checked actigraphs at these times, reminding those who had removed the actigraphs to wear them and checking for device failures. On two separate visits, children were nap and wake promoted (see Spencer et al., 2016). When children were nap promoted, an experimenter tried to keep the children calm and quiet during naptime to encourage them to nap. When children were wake promoted, an experimenter tried to keep children quietly entertained during naptime to prevent them from napping. Sleep variables from these days were excluded from these analyses. On the last day of the study, actigraphs, questionnaires, and sleep diaries were collected. Caregivers received monetary compensation after turning in completed questionnaires and children received storybooks for their participation.

Data analysis

Average daily TV viewing.—Parents reported daily average TV viewing on weekdays and weekends based on five choices: none, < 1 hour, 1–3 hours, 4–6 hours, and 7+ hours. Reports of viewing on weekdays and weekends were strongly correlated ($r = .59$, $p < .001$; Table 1). To increase sample size in each category, children were grouped into three viewing groups: <1 hour per day, 1–3 hours per day, and 4+ hours per day. Five separate univariate

ANCOVAs were run with viewing group (<1 hour, 1–3 hours, 4+ hours) as the independent variable and a measure of sleep (24-hour sleep duration, nap/daytime sleep duration, overnight sleep duration, sleep onset time, wake onset time) as a dependent variable.

Bedroom TV presence.—Five separate univariate ANCOVAs were run with bedroom TV presence as the independent variable and a measure of sleep (24-hour sleep duration, nap/daytime sleep duration, overnight sleep duration, sleep onset time, wake onset time) as a dependent variable. Chi square tests were also run to examine differences in TV use before bedtime, TV programs, mother's education, and family income between children with and without TVs in their bedrooms. Finally, a univariate ANCOVA was run with bedroom TV presence as the independent variable and parent rating of child negative affect as the dependent variable.

Results

The sample for the larger study was 586 children (263 female) with a mean age of 51.15 months (*SD* = 10.00). Not all children in the larger study had actigraphy or questionnaire data, thus analyses for the current study were based on 470 children (217 female) with a mean age of 51.18 months (*SD* = 9.94). This sample was 58.3% Caucasian, 16.4% mixed race, 9.4% African-American, 6.6% Hispanic, 2.1% Chinese, 1.5% Asian Indian, .4% Korean, and .6% Vietnamese. Race was not reported for approximately 5% of this sample. On average, children slept 10.24 hours (*SD*=.66) in a 24-hour period and 9.58 hours (*SD*=.68) overnight. In addition, 95% of children napped over the course of the study. On average, these children napped for 90.26 minutes (*SD*=23.18).

Average daily TV viewing and sleep

For average 24-hour sleep duration, there was a main effect of weekday TV viewing ($F(2,285) = 6.64$, $p = .002$, partial $\eta^2 = .05$; Figure 1). Children who watch <1 hour of TV slept 14 minutes more than children who watch 1–3 hours of TV on an average weekday ($F(1,251) = 11.11$, $p = .001$, partial $\eta^2 = .04$). The mean sleep time for children who watch 4+ hours per day was shorter than that of those who watched <1 hour per day, but this difference was not significant ($F(1, 145) = .54$, $p = .465$, partial $\eta^2 = .004$), likely reflecting the small sample in this group (Table 1). There was also a main effect of weekend TV viewing ($F(2,286) = 4.62$, $p = .011$, partial $\eta^2 = .03$). Children who watch <1 hour of TV slept 23 minutes more than children who watch 4+ hours on an average weekend day ($F(1,90) = 11.60$, $p = .001$, partial $\eta^2 = .11$).

For average overnight sleep duration, there was a main effect of weekday TV viewing (Figure 2; $F(2,285) = 11.95$, $p < .001$, partial $\eta^2 = .08$). Children who watch <1 hour of TV slept 22 minutes more than children who watch 1–3 hours of TV on an average weekday ($F(1,251) = 15.82$, $p < .001$, partial $\eta^2 = .06$). There was also a main effect of weekend TV viewing ($F(2,286) = 11.22$, $p < .001$, partial $\eta^2 = .07$). Children who watch <1 hour of TV slept 11 minutes more than children who watch 1–3 hours of TV on an average weekend day ($F(1,250) = 4.14$, $p = .043$, partial $\eta^2 = .02$) and 38 minutes more than children who watch 4+ hours on an average weekend day ($F(1,90) = 20.64$, $p < .001$, partial $\eta^2 = .19$). Children

who watch 1–3 hours of TV also slept 26 minutes more than children who watch 4+ hours on an average weekend day ($F(1,215) = 13.51$, $p < .001$, partial $\eta^2 = .06$).

For average nap duration, there was a main effect of weekday TV viewing ($F(2,270) = 5.69$, $p = .004$, partial $\eta^2 = .04$; Figure 3). Children who watch 1–3 hours of TV had naps that were 9 minutes longer than naps of children who watch <1 hour of TV on an average weekday ($F(1,251) = 9.43$, $p = .002$, partial $\eta^2 = .04$). There was also a main effect of weekend TV viewing ($F(2,271) = 8.85$, $p < .001$, partial $\eta^2 = .06$). Children who watch 4+ hours of TV napped 17 minutes more than children who watch <1 hour ($F(1,90) = 11.10$, $p = .001$, partial $\eta^2 = .11$) and children who watch 1–3 hours of TV on an average weekend day ($F(1,215) = 17.73$, $p < .001$, partial $\eta^2 = .08$).

For average sleep onset time, there was a main effect of weekday TV viewing ($F(2,285) = 16.95$, $p < .001$, partial $\eta^2 = .11$; Table 2). Children who watch <1 hour of TV went to bed 35 minutes earlier than children who watch 1–3 hours of TV on an average weekday ($F(1,251) = 23.95$, $p < .001$, partial $\eta^2 = .09$). There was also a main effect of weekend TV viewing ($F(2,286) = 8.84$, $p < .001$, partial $\eta^2 = .06$). Children who watch < 1 hour of TV on weekend days went to bed 46 minutes earlier on average than children who watch 4+ hours of TV on an average weekend day ($F(1,90) = 14.09$, $p < .001$, partial $\eta^2 = .14$). Children who watch 1–3 hours of TV went to bed 33 minutes earlier on average than children who watch 4+ hours of TV on an average weekend day ($F(1, 215) = 10.95$, $p = .001$, partial $\eta^2 = .05$).

For average wake onset time, there was a main effect of weekday TV viewing ($F(2,266) = 4.06$, $p = .018$, partial $\eta^2 = .03$; Table 2), but not weekend TV viewing ($F(2,267) = .13$, $p = .877$, partial $\eta^2 = .001$). Children who watch < 1 hour of TV on an average weekday woke up 15 minutes earlier on average than children who watch 1–3 hours of TV on an average weekday ($F(1,251) = 7.70$, $p = .006$, partial $\eta^2 = .03$).

Bedroom TV presence

We examined how the presence of a TV in the child's bedroom was related to sleep. Descriptive data are presented in Table 3. In our sample, 36% of children had TVs in their bedrooms. According to parent reports, 29% said the purpose for the TV is to help their child fall asleep. About 33% of children with TVs in their bedrooms fell asleep with the TV on.

Sleep duration and quality.—On average, children without TVs in their bedrooms slept 30 minutes more during the night compared to those with a TV in their bedroom ($F(1,299) = 43.75$, $p < .001$, partial $\eta^2 = .13$). Although, children with TVs in their bedroom slept 12 minutes more on average during naps ($F(1,283) = 17.16$ $p < .001$, partial $\eta^2 = .06$), nonetheless, they slept 17 minutes less during a 24-hour period than children without TVs in their bedrooms ($F(1,299) = 13.88$, $p < .001$, partial $\eta^2 = .04$). Children with TVs in their bedrooms went to bed 40 minutes later than children without TVs in their bedrooms ($F(1,299) = 42.38$, $p < .001$, partial $\eta^2 = .12$), but they did not wake up significantly later ($F(1,280) = 2.96$, p = .086, partial $\eta^2 = .01$). Children with TVs in their bedrooms also had significantly more variability in total sleep duration, night sleep duration, nap sleep duration,

sleep onset, and wake onset than children without TVs in their bedrooms (Fs>6.05, ps<.015, partial η^2s > .02). Variability in sleep variables is indicated by the standard deviation for each variable.

TV use before bedtime.—Based on the premise that having a TV in the bedroom leads to later viewing, we examined whether the presence of a TV in the bedroom predicted when children stop watching TV before bed (Table 4). A chi square test revealed a difference in nighttime viewing between children with and without TVs in their bedrooms ($\chi^2(6) = 117.93$, $p < .001$, $\varphi = .55$), as children with bedroom TVs watched TV significantly later at night.

TV programs.—Chi square tests for educational children's programs, children's entertainment, and current event programs did not reveal significant differences between children with and without TVs in their bedrooms (ps>.06, φs<.17; Table 5). Children with bedroom TVs watched fewer children's movies, more adult programs, and more adult movies than children without bedroom TVs (ps<.012, φs>.24).

Mother's education and family income.—We also examined the connection between mother's education and presence of a TV in the child's bedroom. A chi square test revealed a difference in mothers' education levels between children with and without TVs in their bedrooms ($\chi^2(5) = 149.32$, $p < .001$, $\varphi = .61$; Table 3). However, mother's education was also strongly correlated with total family income (r=.535, p <.001). For family income, a chi square test revealed a difference in income between children with and without TVs in their bedrooms, with bedroom TV presence more prevalent in low income households ($\chi^2(8) = 95.62$, $p < .001$, $\varphi = .47$; Table 3).

Child temperament.—Given that TV presence was often justified as a way to help children fall asleep, we assessed whether those with bedroom TVs differed in temperament from those without. An ANCOVA revealed a significant main effect of bedroom TV presence for child's negative affect ($F(1,436) = 13.01$, $p < .001$, partial $\eta^2 = .03$). Children with TVs in their bedrooms are rated higher on negative affect ($M = 4.04$, $SD = .84$) than children without TVs in their bedrooms ($M = 3.71$, $SD = .90$).

Discussion

Contrary to the recommendations of the American Academy of Pediatrics, many children watch substantial amounts of TV each day, and some children even watch it in their bedrooms (Rideout, 2017). These factors can impair cognitive abilities (Mistry et al., 2006), but the most important influence is on children's sleep (Brockmann et al., 2016). Using objective measures of sleep, our results replicate previous reports of the impairing roles of TV viewing time and presence of a bedroom TV on sleep in early childhood (Cain & Gradisar, 2010; Calamaro et al., 2011; Cespedes et al., 2014). We also extend these prior results, demonstrating an increase in nap length with TV viewing that nonetheless fails to equate sleep time in 24 hours with those who watch less TV.

Children who watch little or no TV got more sleep overall and at night than children who watch over an hour of TV each day. In addition, the presence of a TV in children's bedrooms was associated with shorter sleep duration and poor sleep quality. This finding could indicate that TV viewing and bedrooms TVs impact sleep and wake onset. These findings are consistent with prior studies on this age range (Brockmann et al., 2016; Cain & Gradisar, 2010; Cespedes et al., 2014; Garrison et al., 2010; Nathanson & Fries, 2014; Paavonen et al., 2006; Przybylski, 2018). However, previous studies used parent-report estimates of sleep, whereas the current study utilized actigraphy measures. This type of sleep measurement provides more accurate reports of children's sleep and wake times.

Actigraphy also allowed us to examine how mid-day napping was influenced by TV viewing and bedroom TVs. Children who viewed more TV and have TVs in their bedrooms compensated for some lost overnight sleep with daytime naps. However, their overall 24-hour sleep duration remained shorter than that of children who watched less TV and do not have TVs in their bedrooms. Interestingly, children with TVs in their bedrooms were significantly older than the children without TVs in their bedrooms, yet they napped longer. If these children rely on daytime naps to meet their sleep need, then the transition away from daytime naps may be more difficult. Limitations on viewing duration and the removal of the TV from the bedroom may be important.

The presence of a bedroom TV was greater in children of low-income and low-education mothers. Among children without TVs in their bedrooms, 80% of their mothers have a college degree or higher level education, whereas the rate is only 33.2% among children with TVs in their bedrooms. Likewise, 74.1% of children with bedroom TVs were in households with an income of <$40,000. The association between bedroom TV presence and TV viewing with socio-economic factors is well known (Borghese et al., 2015; Certain & Kahn, 2002).

Having a TV in a child's bedroom can impact sleep for a variety of reasons. In this sample, about 13% of children with TVs compared to 50% of children without TVs in their bedrooms stop watching an hour before they go to bed. This extensive usage before bed may provide an explanation for worse sleep quality and shorter sleep duration among children with TVs in their bedrooms. One possibility is that the light emitted from the TV screen impacts sleep by delaying melatonin release and disrupting a child's circadian rhythms (Brockmann et al., 2016; Calamaro et al., 2011).

Viewing TV before bed may also relate to the types of programs these children are watching. In this study, children with TVs in their bedrooms were reported to watch more adult content than children without TVs in their bedrooms. This content is likely more mentally and emotionally arousing than child-directed content, thus negatively influencing children's sleep (Cespedes et al., 2014; Nathanson & Fries, 2014).

The current study accounted for many variables and added an objective measure of sleep, but it had some limitations. Most importantly, measures of TV viewing relied on parent reports, requiring parents to be aware of TV viewing when they were not likely present. Moreover, our study measured TV use and not separate or additive impact of mobile devices. In the

future, it will be imperative to include questions about use of other technology such as tablets and smart phones. Additionally, reported measures represent associations and not necessarily causation. There is the possibility that children who already have difficulty falling asleep are provided with the opportunity to watch more TV, to watch TV later, and to watch TV in their bedrooms to aid sleep onset. Given know associations between TV viewing and childhood obesity (e.g., Jago et al., 2005), these data also suggest further consideration should be given to whether sleep may mediate this relationship.

Conclusions

The results point to a need to consider TV viewing and bedroom TV access in efforts to improve child sleep quality, especially in early childhood. Future research examining additional factors will serve to elucidate these connections and allow researchers to educate society further on the impacts of TV use on sleep in children as well as adults.

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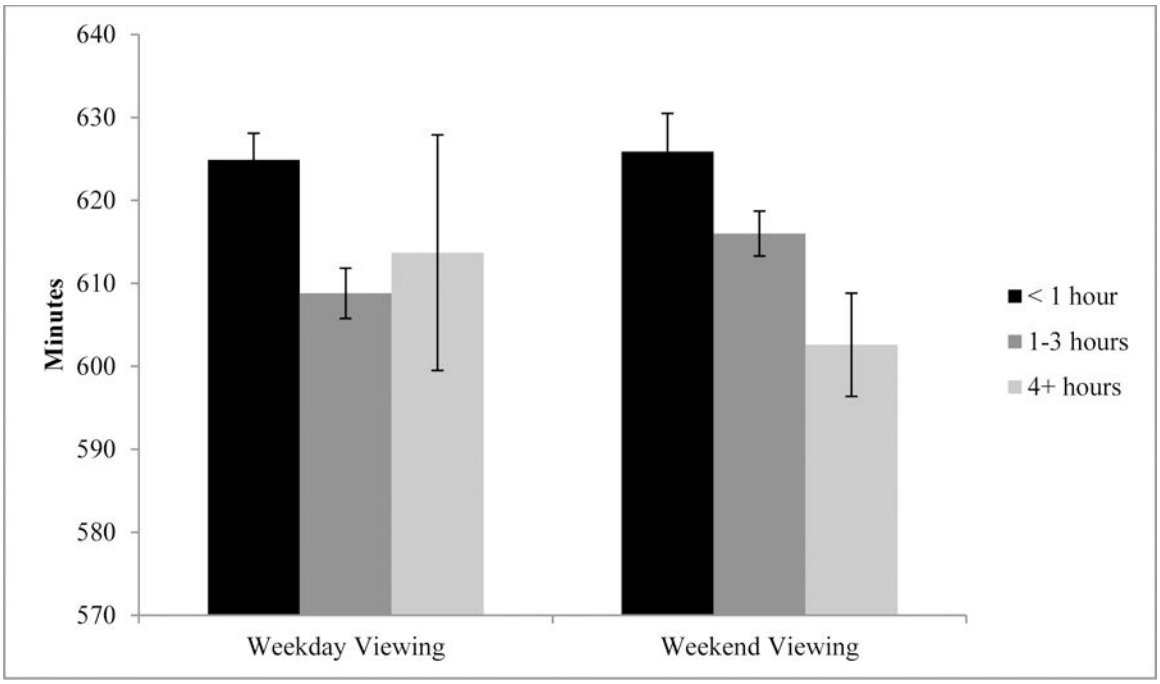

Figure 1.
Total sleep duration as a function of viewing time and group.

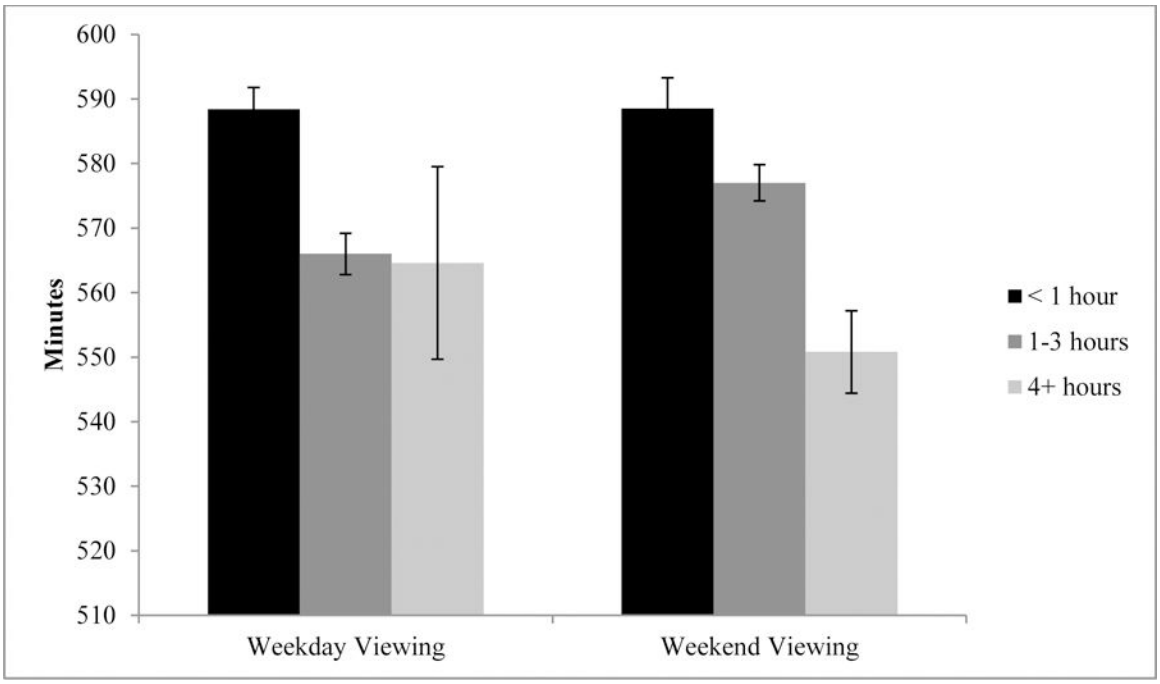

Figure 2.
Nighttime sleep duration as a function of viewing time and group.

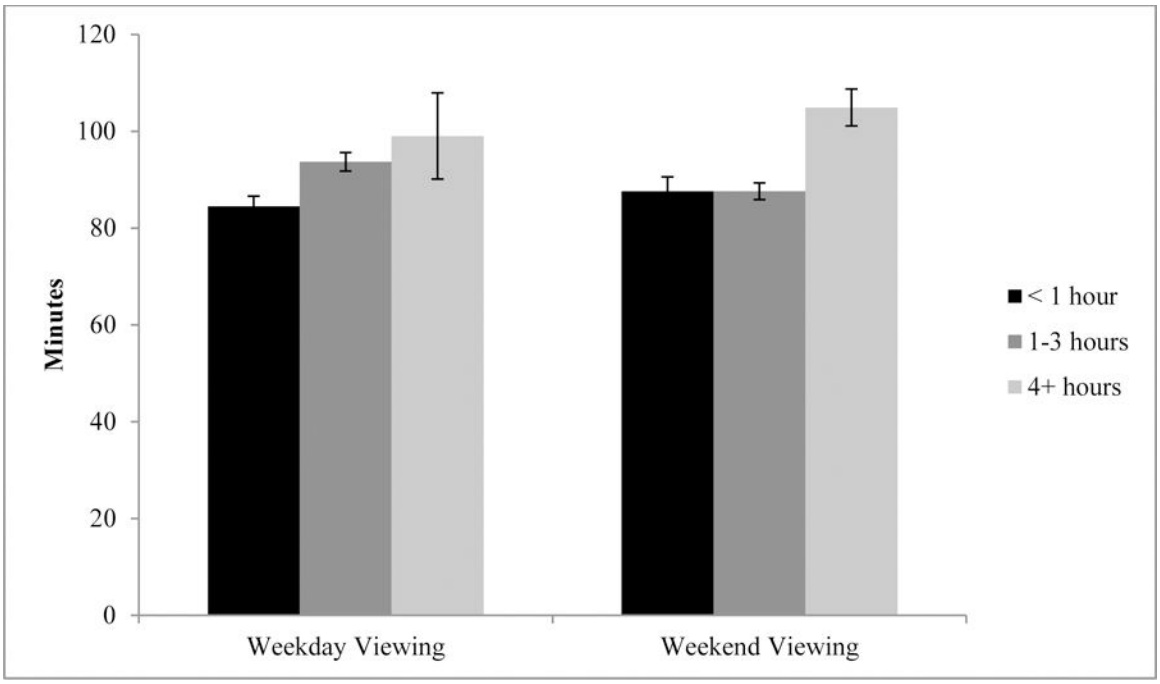

Figure 3.
Nap duration as a function of viewing time and group.

Table 1.

Frequency data for average daily TV viewing on weekdays and weekends.

	Weekdays (Monday-Friday)	Weekends (Saturday & Sunday)
None	18	5
<1 hour	118	62
1–3 hours	150	189
4–6 hours	6	34
7+ hours	1	4
Total	293	294

Table 2.

Sleep and wake onset (decimalized 24-hour time) as functions of viewing group for weekday and weekend TV viewing.

	Weekday TV Viewing			Weekend TV Viewing		
	<1 hour	**1–3 hours**	**4+ hours**	**<1 hour**	**1–3 hours**	**4+ hours**
Sleep Onset	21.14 (.79)	21.75 (.94)	21.77 (.50)	21.21 (.93)	21.45 (.90)	21.98 (.76)
Wake Onset	6.92 (.69)	7.19 (.74)	6.99 (.68)	7.01 (.76)	7.07 (.69)	7.10 (.86)

Table 3.

Descriptive data based on bedroom TV presence.

	Bedroom TV (N=168)	No Bedroom TV (*N*=302)
Sex, F:M	76:92	141:161
Age, months (*SD*)	52.98 * (9.69)	50.17 * (9.95)
Mother's education		
Less than 12th grade	6.1%	.8%
High school degree or GED	24.3%	3.5%
Some college	36.5%	15.1%
Associate's degree	16.9%	6.0%
Bachelor's degree	14.9%	23.0%
Master's or Ph.D.	1.4%	51.6%
Family Income		
$5,000 or less	9.9%	3.8%
$5,001 to 10,000	15.2%	2.1%
$10,001 to 20,000	21.2%	7.2%
$20,001 to 40,000	27.8%	19.6%
$40,001 to 70,000	11.9%	12.0%
$70,001 to 100,000	5.3%	18.2%
$100,001 to 150,000	4.0%	19.6%
More than $150,000	2.6%	15.5%
Not reported	2.0%	2.1%

* *Yes* > *No,* $t(467) = 2.96$, $p = .003$

Table 4.

Typical conclusion of daily TV viewing as a function of bedroom TV presence.

	Bedroom TV	No Bedroom TV
Does not watch	.7%	5.7%
3 hours before bedtime	1.5%	13.9%
2 hours before bedtime	2.9%	12.6%
1 hour before bedtime	8.0%	19.1%
30 minutes before bedtime	27.0%	32.2%
Immediately before bedtime	27.8%	15.2%
Falls asleep with TV on	32.2%	1.3%

Table 5.

TV programs viewed as a function of TV presence

	Bedroom TV	No Bedroom TV
Educational children's programs	92.1%	92.5%
Entertaining children's programs	93.4%	83.5%
Children's movies	96.7%	80.4%
Adult programs	23.3%	2.5%
Current event programs	23.0%	13.4%
Adult movies	25.0%	1.9%