

# Media Use and Child Sleep: The Impact of Content, Timing, and Environment

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## KEY WORDS

sleep, media, violence, television, child, preschool

## ABBREVIATIONS

SCBE—Social Competence and Behavior Evaluation  
CI—confidence interval

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**WHAT'S KNOWN ON THIS SUBJECT:** Media use has been shown to negatively affect child sleep, especially in the context of evening use or with a television in the child's bedroom.



**WHAT THIS STUDY ADDS:** Increased sleep problems were observed in preschool-aged children for each additional hour of daytime violent media content or evening media use. No such effect was observed with nonviolent daytime use.

## abstract



**BACKGROUND:** Media use has been shown to negatively affect a child's sleep, especially in the context of evening use or with a television in the child's bedroom. However, little is known about how content choices and adult co-use affect this relationship.

**OBJECTIVE:** To describe the impact of media content, timing, and use behaviors on child sleep.

**METHODS:** These data were collected in the baseline survey and media diary of a randomized controlled trial on media use in children aged 3 to 5 years. Sleep measures were derived from the Children's Sleep Habits Questionnaire. Media diaries captured time, content title, and co-use of television, video-game, and computer usage; titles were coded for ratings, violence, scariness, and pacing. Nested linear regression models were built to examine the impact of timing, content, and co-use on the sleep problem score.

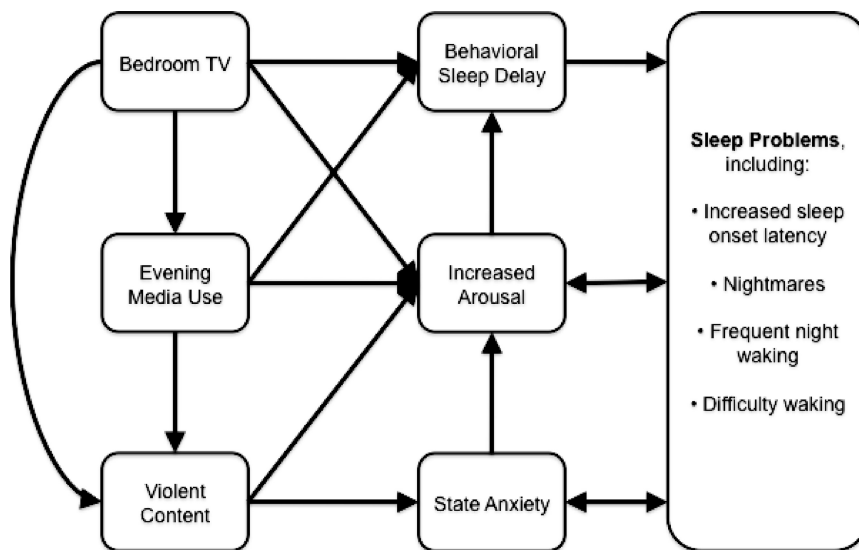
**RESULTS:** On average, children consumed 72.9 minutes of media screen time daily, with 14.1 minutes occurring after 7:00 PM. Eighteen percent of parents reported at least 1 sleep problem; children with a bedroom television consumed more media and were more likely to have a sleep problem. In regression models, each additional hour of evening media use was associated with a significant increase in the sleep problem score (0.743 [95% confidence interval: 0.373–1.114]), as was daytime use with violent content (0.398 [95% confidence interval: 0.121–0.676]). There was a trend toward greater impact of daytime violent use in the context of a bedroom television ( $P = .098$ ) and in low-income children ( $P = .07$ ).

**CONCLUSIONS:** Violent content and evening media use were associated with increased sleep problems. However, no such effects were observed with nonviolent daytime media use. *Pediatrics* 2011;128:29–35

Sleep problems are common in preschool-aged children. According to parents in primary care settings, 21% have at least 2 sleep problems.<sup>1</sup> Short-term consequences associated with sleep problems in young children include injury risk,<sup>2,3</sup> behavior problems,<sup>4,5</sup> and parental stress and sleep loss.<sup>6,7</sup> Long-term sequelae are even more concerning, including later development of mental illness,<sup>8</sup> obesity,<sup>9,10</sup> and school failure.<sup>11</sup>

Studies have found that 20% to 43% of US preschool-aged children have a television in their bedroom,<sup>12–15</sup> and many families report “helping the child fall asleep” is 1 of the primary reasons.<sup>12,16</sup> Although bedroom televisions have been associated with delayed bedtimes, difficulty falling asleep, and less overall sleep,<sup>5,14,15,17</sup> the mechanisms remain unclear. Although bedroom television is associated with increased hours of daily screen time,<sup>13</sup> other potential pathways exist (Fig 1). A bedroom television may increase opportunities to watch violent or frightening content, and adult-targeted television content has been associated with increased sleep problems in young children.<sup>18</sup> In addition, because many families are using television as part of the child’s bedtime routine, television viewing may displace more soothing bedtime rituals. Television viewing at bedtime, regardless of location, may result in increased autonomic activation due to hyperarousal<sup>19</sup> or disrupted melatonin production via brightly lit screens.<sup>20–22</sup>

To the best of our knowledge, no published studies to date have explored the roles played by content type, timing, and co-use in media-related sleep problems. Thus, the goal of this article was to describe the impact of media content, timing, and use behaviors on child sleep.



**FIGURE 1**  
Theoretical model.

### METHODS

These data were from the baseline survey and media diary in a randomized controlled trial promoting healthy media use in preschool-aged children. Letters describing the study were sent to families with age-eligible children (3–5 years) enrolled in community pediatric practices without regard to whether the child had been seen in the clinic recently. As a result, the study more closely approximates a population-based sample than a clinical sample. To be eligible, children needed to consume at least some media each week and to have English-speaking parents. Families were given the opportunity to “opt out” of additional recruitment efforts and also had the option to “opt in” by returning a postage-paid mailer. Those who neither opted out nor in were contacted by telephone and asked to participate. Attempts were made to oversample low-income families, as identified by Medicaid status or zip code of residence. After enrollment, the survey and media diary were collected by study staff during a home visit at the start of the intervention. The baseline data from both study arms, before the

intervention, were used for this study. Of the 3334 families contacted and assessed for eligibility, 40% did not meet inclusion criteria, 35% declined to participate, and the remaining 25% ( $N = 820$ ) were randomly assigned; 75% (617 of 820) completed both the parent survey and media diary at baseline and are included in this analysis.

Sleep measures, a subset of the Children’s Sleep Habits Questionnaire,<sup>23</sup> were used to assess the frequency of sleep-onset latency, repeated night wakings, nightmares, difficulty waking in the morning, and daytime tiredness. Frequency choices were usually (5–7 times per week), sometimes (2–4 times per week), and rarely (0–1 time per week). The items were summed after inverting the reversed item (latency), with a total score ranging from 5 to 15 and higher scores indicating more problematic sleep. Internalizing and externalizing symptoms were assessed using the Social Competence and Behavior Evaluation (SCBE), parent version. The SCBE is a validated measure with subscales for internalizing (anxious, depressive, and withdrawn) and externalizing (angry, aggressive, and oppositional) behav-

iors.<sup>24,25</sup> Neither SCBE scale includes any questions about child sleep. Missing data for the questions contributing to the sleep, internalizing, and externalizing scales were imputed using the Stata impute command (Stata Corp, College Station, TX) for subjects with no more than 20% of items missing in the scale. Each item used in the analysis had <2% of values missing.

In the media diaries, families prospectively recorded all screen time for the child across 1 week, a method that has been shown to have greater validity than parental retrospective report alone.<sup>26</sup> Diary data were included if families completed at least 3 of the 7 days. Families were instructed to record days of no media use as 0 use; days with no data were treated as missing rather than days of no use. The first wave was coded by 2 researchers (Ms Liekweg and Dr Garrison) until 90% agreement was reached, with disagreements resolved through consensus. Subsequent diaries were coded by 1 researcher (Ms Liekweg), with a random 5% also coded by the second researcher to ensure that 90% agreement was maintained.

Diaries captured time, content title, and co-use for television, video-game, and computer usage, and were subsequently coded for ratings, content, and pacing. Ratings were recorded from the official TV Parental Guidelines, Motion Picture Association of America (movie or video), or Entertainment Software Rating Board (video and computer game). Ratings across format types were combined by recommended age group; for example, the Motion Picture Association of America rating of G, the TV Parental Guidelines ratings of Y and G, and the software rating of EC were combined into a single category (all are considered appropriate for children younger than 7 years). Co-use was categorized as use with another adult, with another child

but not with an adult, or alone, and was based on parent report on each line of the media diary.

The protocol for coding violence was based on that used for the Child Development Supplement of the Panel Study of Income Dynamics<sup>27</sup>; violence was categorized for each program according to frequency (none, isolated, episodic, or central) and type (mild/slapstick, fantasy violence, sports violence, realistic, or gratuitous). Scary content was coded with the same frequency categories as violence. Prosocial and educational content were coded as primary, incidental, or none according to the role the factor played in the content. Two pacing factors were coded: frequency of rapid movement (none, isolated, episodic, central, or extreme) and the rate at which abrupt changes in the background occur.<sup>28–30</sup> For the latter, at least two 5-minute segments were counted, and the mean was coded.

Using media diary data, we calculated average daily media use overall and according to content characteristics and co-use. We also specifically looked at use after 7:00 PM (evening) compared with the rest of the day (daytime) as a proxy for near-bedtime media usage, given that median bedtimes in this age group are between 8:00 and 10:00 PM.<sup>14</sup> Descriptive statistics were calculated, and variables were compared between groups using  $\chi^2$  tests for categorical variables and *t* tests for continuous variables. We compared daytime and evening media use characteristics, overall and in children with and without a bedroom television. Using linear regression, we tested each of our hypotheses in a series of nested models, and sought to build the model that best described the impact of media content, timing, and use behaviors on child sleep. Hypotheses were tested using the Wald statistic. These hypotheses included that evening (ie, after

7:00 PM) media use would have a greater impact on sleep than daytime use. Additional hypotheses were that violent media content (of any violence type and episodic or central frequency) would have a greater impact than nonviolent content and that co-use with an adult would partially mitigate the impact of media use on child sleep. Another hypothesis was that the impact of media use on child sleep would be increased in the context of a television in the child's bedroom.

Media use characteristics were included in the models as hours of average daily use; in each nested model, the sum of the included media use covariates equaled the total average daily use. All regression models controlled for child gender, low-income status, single-adult household, and SCBE internalizing and externalizing scores, as well as which parent completed the survey (mother versus other). The study was approved by the institutional review board of the Seattle Children's Research Institute.

## RESULTS

All 617 children in the study had  $\geq 3$  days of diary data, but 3 had insufficient sleep data and 2 were missing demographic covariates, resulting in an analytic sample of 612 (99%). Of these children, 55% were male, 18% were from low-income households, and 10% had a bedroom television (Table 1). Children with a bedroom television were more likely to be low-income or single-adult households. Sleep problems were common, with 18% of families reporting the child experienced at least 1 of the queried sleep problems 5 to 7 days per week. The most frequently reported problem was difficulty with sleep-onset latency, and children with a bedroom television were more likely to have parent-reported daytime tiredness (8% vs 1%;  $P < .01$ ). The sleep problem scale

**TABLE 1** Descriptive Characteristics

	Total Sample ( <i>N</i> = 612) <sup>a</sup>	Television in Bedroom ( <i>n</i> = 59)	No Television in Bedroom ( <i>n</i> = 551)
Demographic characteristics			
Female gender, %	45	37	46
Age, mean (SD), mo	51 (8)	50 (7)	51 (8)
Low-income household, % <sup>b</sup>	18	69	13
Single-adult household, % <sup>b</sup>	6	25	4
SCBE scores, mean (SD)			
Externalizing	14.3 (5.0)	13.3 (5.0)	14.4 (5.0)
Internalizing	11.6 (4.6)	10.9 (3.9)	11.7 (4.6)
Social competence	32.1 (6.0)	30.6 (6.4)	32.2 (5.9)
Sleep scale, mean (SD) <sup>b</sup>	6.4 (1.4)	7.0 (1.7)	6.4 (1.3)
Problems occurring 5 to 7 d/wk, %			
Any	18	29	17
Sleep onset takes ≥20 min	12	19	11
Wakes up more than once a night	6	5	6
Wakes with nightmares	<1	2	<1
Daytime tiredness <sup>b</sup>	2	8	1
Takes a long time to become alert in the morning	4	5	4

<sup>a</sup> Includes 2 families with missing bedroom television status.

<sup>b</sup> *P* < .05 for comparison between groups.

**TABLE 2** Media Use Characteristics in Mean (SD) Minutes per Day

	Total Sample		No Bedroom Television		Bedroom Television	
	Daytime	Evening	Daytime	Evening	Daytime	Evening
Total	58.8 (42.7)	14.1 (17.4)	56.4 (40.5)	12.6 (15.6)	81.6 (55.1)	27.6 (26.1)
Range	0–274	0–124	0–240	0–111	0–274	0–124
Format						
Television or video	53.6 (40.3)	12.9 (16.0)	51.5 (38.4)	11.7 (14.6)	73.3 (51.6)	24.2 (23.2)
Computer	2.6 (8.3)	0.4 (2.3)	2.5 (8.3)	0.3 (1.9)	3.1 (8.1)	1.4 (4.5)
Video game	2.6 (9.9)	0.8 (4.0)	2.4 (9.6)	0.6 (3.7)	5.2 (12.7)	2.0 (6.1)
Co-use						
Adult	38.9 (39.7)	11.2 (15.9)	37.0 (37.3)	10.2 (14.8)	58.0 (55.0)	20.8 (22.1)
Another child	12.7 (22.5)	2.2 (6.3)	12.0 (20.6)	1.9 (5.3)	18.3 (35.4)	4.6 (11.8)
Alone	7.2 (13.7)	0.7 (3.1)	7.4 (13.9)	0.5 (2.3)	5.2 (10.6)	2.2 (6.8)
Rating						
Not rated	12.5 (18.8)	3.2 (7.4)	11.7 (18.2)	2.9 (7.0)	18.9 (23.3)	6.3 (10.4)
Young child	37.4 (30.3)	6.3 (10.2)	36.4 (29.4)	5.5 (9.2)	46.9 (36.1)	12.8 (15.2)
Older child	8.4 (14.4)	3.9 (7.9)	7.8 (13.8)	3.6 (7.7)	14.1 (18.4)	6.2 (9.5)
Teen or adult	0.6 (3.4)	0.7 (3.8)	0.5 (2.6)	0.6 (2.9)	1.7 (7.3)	2.3 (8.4)
Pacing						
Slow	16.8 (20.8)	2.3 (5.5)	16.4 (19.8)	2.1 (5.1)	20.6 (28.7)	3.9 (7.3)
Medium	21.5 (22.3)	5.2 (9.7)	20.7 (22.2)	4.7 (8.9)	28.6 (22.4)	10.6 (14.3)
High	4.2 (9.0)	0.9 (3.3)	4.0 (8.8)	0.8 (3.0)	6.6 (11.2)	2.2 (5.6)
Content <sup>a</sup>						
Prosocial	27.1 (26.4)	3.9 (7.4)	26.5 (25.7)	3.5 (6.6)	33.1 (31.4)	7.8 (12.2)
Educational	21.9 (23.7)	1.9 (4.9)	21.6 (23.4)	1.9 (4.9)	25.1 (26.4)	2.3 (4.2)
Violent	21.2 (26.9)	7.8 (12.7)	20.0 (26.1)	7.0 (11.7)	32.4 (32.1)	15.7 (18.2)
Scary	18.5 (21.8)	6.1 (10.3)	17.7 (21.0)	5.4 (9.0)	25.9 (27.5)	13.0 (17.0)
Violence frequency						
Isolated	4.3 (8.9)	1.7 (5.2)	4.3 (9.0)	1.5 (4.9)	4.5 (7.9)	3.4 (7.1)
Episodic	13.4 (19.7)	5.2 (10.1)	12.3 (18.4)	4.8 (9.6)	23.3 (28.2)	9.4 (13.4)
Central	3.5 (9.3)	1.0 (3.5)	3.4 (9.4)	0.7 (2.9)	4.6 (9.1)	3.0 (6.6)
Violence type						
Mild/slapstick	8.7 (17.3)	2.4 (5.7)	8.0 (14.2)	2.2 (5.5)	15.7 (22.4)	4.4 (7.1)
Fantasy violence	5.9 (11.0)	2.0 (5.4)	5.6 (11.0)	1.8 (4.9)	7.8 (11.3)	4.3 (8.4)
Sports violence	5.1 (10.8)	1.9 (10.8)	5.1 (11.0)	1.7 (5.6)	4.8 (8.5)	3.4 (7.1)
Realistic	1.6 (5.7)	1.5 (5.4)	1.3 (5.1)	1.2 (5.0)	4.2 (9.8)	3.6 (8.6)

<sup>a</sup> Content categories are neither mutually exclusive nor comprehensive.

ranged from 5 to 12 in this population (mean: 6.4) and was significantly higher in the bedroom television group (*P* < .01).

Average daily screen time was 72.9 minutes (Table 2), with 58.8 minutes in the daytime (before 7:00 PM), and 14.1 minutes in the evening (after 7:00 PM). Compared with daytime use, evening use was more likely to have ratings for older children or adults, to have violent or scary content, and to occur with adult co-use. Although violent content accounted for a greater proportion of evening use, content consumed within categories was similar across time periods; for both violent and nonviolent content, 8 of the top 10 content titles were the same for daytime and evening. Not surprisingly, screen time was significantly greater for children who had a bedroom television, with an additional 40 minutes across the day. Subsequently, children with a bedroom television also consumed significantly more violent or scary content or content rated for older children or adults. However, the proportion of daily content represented by these categories was similar to those in children without a bedroom television.

In model 1, total screen time was associated with sleep problems, with an increase in the sleep problem score of 0.244 (95% confidence interval [CI]: 0.113 to 0.375) for every additional hour of daily media use (Table 3). In model 2, we split total media use into daytime and evening use, and confirmed our hypothesis (*P* < .01) that evening use has a greater impact (0.819 [95% CI: 0.450 to 1.188]) than daytime use (0.107 [95% CI: -0.047 to 0.260]). In model 3, both daytime and evening use were further split into violent and nonviolent content. For daytime use, there was a negative impact of violent media consumption on sleep problem score but no impact of nonviolent daytime media use (*P* = .048 for

**TABLE 3** Regressions: Change in Sleep Problem Score for Each Additional Hour of Media Use

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Total time	0.244 <sup>a</sup>	—	—	—	—	—	—
Day time	—	0.107	—	—	—	—	—
Evening time	—	0.819 <sup>a</sup>	—	0.743 <sup>a</sup>	—	—	0.722 <sup>a</sup>
Nonviolent day time	—	—	0.016	0.022	0.007	0.015	0.012
Violent day time	—	—	0.393 <sup>b</sup>	0.398 <sup>b</sup>	—	—	—
Nonviolent evening time	—	—	0.839 <sup>c</sup>	—	—	—	—
Violent evening time	—	—	0.818 <sup>b</sup>	—	—	—	—
Violent day with adult co-use	—	—	—	—	0.377 <sup>c</sup>	—	—
Violent day alone	—	—	—	—	0.457	—	—
Evening with adult co-use	—	—	—	—	0.933 <sup>b</sup>	—	—
Evening without adult	—	—	—	—	0.607 <sup>c</sup>	—	—
Violent day, no bedroom television	—	—	—	—	—	0.299	0.304 <sup>c</sup>
Violent day with bedroom television	—	—	—	—	—	0.796 <sup>b</sup>	0.773 <sup>b</sup>
Evening, no bedroom television	—	—	—	—	—	0.729 <sup>b</sup>	—
Evening with bedroom television	—	—	—	—	—	0.667 <sup>c</sup>	—
Adjusted R <sup>2</sup>	0.0936	0.1079	0.1141	0.1155	0.1138	0.1157	0.1178

— indicates that the variable was not included in this model iteration.

<sup>a</sup>  $P < .001$ .

<sup>b</sup>  $P < .01$ .

<sup>c</sup>  $P < .05$ .

the difference in effects). Within evening use, the differences between violent and nonviolent media use were not statistically significant ( $P = .96$ ), so these 2 categories were recombined for the subsequent model. In model 4, there were significant increases in sleep problem scores with each additional hour of evening media use (0.743 [95% CI: 0.373 to 1.114] or daytime violent media use (0.398 [95% CI: 0.121 to 0.676]). Again, there was no impact of daytime nonviolent media use, which continued to be the case throughout all subsequent models.

In model 5, we examined whether co-use with an adult mitigated the effects, and split both evening media use and daytime violent use according to whether it occurred with adult co-use.

Using the Wald tests, we found no differences in effect with adult co-use versus without adult co-use for either evening media use ( $P = .35$ ) or daytime violent use ( $P = .79$ ). To test the last hypothesis, in model 6 we split evening media use and daytime violent use according to whether the child had a bedroom television. There were no significant differences between evening use with and without a bedroom television ( $P = .87$ ), so we recombined those for model 7, in which we observed a trend for an increased effect of daytime violent media use in children with a bedroom television ( $P = .098$ ). Although this trend was intriguing, it did not reach the cutoff for statistical significance; as a result, we chose model 4 as our final model (Table 4).

**TABLE 4** Final Regression Model

	Change in Sleep Score	95% CI	P
Each additional hour of nonviolent daytime media time	0.022	−0.186 to 0.229	.84
Each additional hour of violent daytime media time	0.398	0.121 to 0.676	<.01
Each additional hour of evening media time	0.743	0.373 to 1.114	<.001
Responding parent is mother	−0.399	−0.706 to −0.091	.01
Female	0.170	−0.037 to 0.377	.11
Low-income household	0.338	0.054 to 0.622	.02
Single-adult household	0.611	0.174 to 1.048	<.01
SCBE externalizing score	0.039	0.018 to 0.061	<.001
SCBE internalizing score	0.025	0.002 to 0.048	.04

In this final model, we found significant increases in the sleep problem score for violent daytime media (0.398 increase with each additional hour of use [95% CI: 0.121 to 0.676]) and any evening media use (0.743 [95% CI: 0.373 to 1.114]). Conversely, nonviolent daytime media use had no significant impact on the sleep score (0.022 [95% CI: −0.186 to 0.229]). Regression diagnostics on this model found no overall problems with nonlinearity, severe outliers, significant multicollinearity, or specification errors. In examining the residuals, we found model fit to be somewhat less specific in children with sleep problem scores in the top 1% than for the rest of the sample.

Our ability to examine effect modification according to child characteristics was limited by our smaller sample in the potentially vulnerable subgroups. No significant differences were observed in effects when media use covariates were split according to internalizing or externalizing status, and neither did the results of the final model change significantly when the internalizing and externalizing scale variables were excluded. There was no effect modification according to gender, but there was a trend ( $P = .07$ ) toward a greater effect of daytime violent use in children from low-income (0.761 [95% CI: 0.276 to 1.246]) compared with non-low-income (0.239 [95% CI: −0.089 to 0.567]) households.

In secondary analyses raised by the aforementioned findings, we examined the individual components of the sleep problem score and more detailed categorizations of content. Across components, we found a significant effect of evening media use on sleep-onset latency (0.204 [95% CI: 0.01 to 0.403]), nightmares (0.085 [95% CI: 0.005 to 0.165]), and daytime tiredness (0.162 [95% CI: 0.030 to 0.294]), and a trend toward an effect on night wakings and hard time waking in the morning. Al-

though we found no impact of daytime violent use on sleep-onset latency or night wakings, there was an impact on nightmares (0.087 [95% CI: 0.027 to 0.147]), hard time waking in the morning (0.170 [95% CI: 0.061 to 0.279]), and daytime tiredness (0.111 [95% CI: 0.012 to 0.210]).

Although the primary analyses focused on violent content meeting the frequency criteria for episodic or central, we also examined the individual frequency categories. We found no significant difference in effect between content with isolated violence and no violence ( $P = .61$ ) and likewise no significant difference between episodic and central violence ( $P = .66$ ). For type of violence, there were no significant differences between fantasy violence, mild/slapstick violence, sports violence, or realistic violence, and no content meeting criteria for gratuitous violence was reported. There were also no significant differences between the effects of animated and live-action violence ( $P = .37$ ). In addition, although we examined “scary” content as well, the large degree of overlap between “scary” and “violent” content in the media consumed by this age group meant that there was no marginal effect of scary content above and beyond the effect of violence. We also explored to what degree official ratings from the Motion Picture Association of America, TV Parental Guidelines, and Entertainment Software Rating Board were an effective proxy measure for violence in the media content reported. When we replaced the daytime violent and nonviolent categories in the analysis with those split according to ratings category, we found no significant difference in the impact on sleep between content rated as appropriate for young children and those with a nonrated designation, and likewise no significant difference between content rated as appropriate for older chil-

dren and content rated for adolescents or adults. As with violent content, daytime media use of content rated for older children, teenagers, or adults was associated with a significant increase in the sleep problem score (0.58 [95% CI: 0.15 to 1.01]). As with nonviolent content, daytime use of content rated for young children did not have a significant impact on sleep (0.03 [95% CI:  $-0.18$  to 0.24]).

## DISCUSSION

We confirmed the association of media use with sleep problems in preschool-aged children and extended those findings in our examination of content and timing. We found that evening media use and daytime violent media use were both associated with increased sleep problems, but daytime nonviolent media use was not. These effects were not mitigated by adult co-use, nor did they seem to vary according to type of violence or whether content was animated versus live-action. Furthermore, we found the official ratings provided by the Motion Picture Association of America, TV Parental Guidelines, and Entertainment Software Rating Board to be an informative proxy for parents wanting to reduce violent content and the subsequent impact on sleep.

As with previous research, children with a bedroom television tended to consume more media and were also more likely to have sleep problems. Not only did these children have greater media use overall, but they averaged an additional 15 minutes of evening use and 12 minutes of daytime violent use, both of which increase the ++risk of sleep problems. It also seems possible that a bedroom television has an impact on child sleep beyond that due to increased evening use and violent content alone: the trend toward an increased effect

of daytime violent content with a bedroom television suggests potential pathways. Decreased parental supervision may play a role, or viewing violent content in the bedroom may increase the likelihood of the child thinking about it at bedtime. Most plausible is that media diaries may simply underreport total media use (especially violent use) when a child has a bedroom television.

There are several limitations to our research. First, this analysis used cross-sectional, observational data. It is possible unmeasured child- or family-level confounders were influencing both media use and child sleep, or that some parents are responding to child sleep problems with increased evening media use. Furthermore, media use and child sleep data were based on parent report. Total media use was likely underreported to some degree, and social desirability bias may have resulted in overreporting of co-use and/or underreporting of violent content. In addition, although we used a bedroom television as a variable, we were not able to ascertain whether any given hour of use involved the bedroom television versus another television. The child sleep data have the additional limitation of being retrospective. Also, because no data were collected on other conditions, we were unable to examine whether, for example, the effects might differ in children with attention-deficit/hyperactivity disorder. Although these issues point to areas that need strengthening in future research, they are also largely limitations that would be expected to bias our results toward the null.

Overall, these findings contribute to current knowledge about how media use affects child sleep. Pediatricians can advise parents to focus on reducing violent content and evening media use, which may be both more accept-

able and feasible for families living in the digital age than focusing on a global reduction or elimination of media use. For families reluctant to change their child's media use, discussion about the impact on sleep may increase parental motivation. Future

research in this area should examine whether changes in child media use can significantly improve a child's sleep over time, as well as the degree to which inadequate sleep mediates the previously reported relationship between high levels of media use and

subsequent child behavior and learning problems.

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