

Television Viewing, Computer Game Playing, and Internet Use and Self-Reported Time to Bed and Time out of Bed in Secondary-School Children

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Objective: To investigate the relationship between the presence of a television set, a gaming computer, and/or an Internet connection in the room of adolescents and television viewing, computer game playing, and Internet use on the one hand, and time to bed, time up, time spent in bed, and overall tiredness in first- and fourth-year secondary-school children on the other hand.

Methods: A random sample of students from 15 schools in Flanders, Belgium, yielded 2546 children who completed a questionnaire with questions about media presence in bedrooms; volume of television viewing, computer game playing, and Internet use; time to bed and time up on average weekdays and average weekend days; and questions regarding the level of tiredness in the morning, at school, after a day at school, and after the weekend.

Results: Children with a television set in their rooms went to bed significantly later on weekdays and weekend days and got up significantly later on weekend days. Overall, they spent less time in bed on weekdays. Children with a gaming computer in their rooms went to bed significantly later on weekdays. On weekdays, they spent significantly less time in bed. Children who watched more television went to bed later on weekdays and

weekend days and got up later on weekend days. They spent less time in bed on weekdays. They reported higher overall levels of being tired. Children who spent more time playing computer games went to bed later on weekdays and weekend days and got up later on weekend days. On weekdays, they actually got up significantly earlier. They spent less time in bed on weekdays and reported higher levels of tiredness. Children who spent more time using the Internet went to bed significantly later during the week and during the weekend. They got up later on weekend days. They spent less time in bed during the week and reported higher levels of tiredness. Going out was also significantly related to sleeping later and less.

Conclusion: Concerns about media use should not be limited to television. Computer game playing and Internet use are related to sleep behavior as well. Leisure activities that are unstructured seem to be negatively related to good sleep patterns. Imposing more structure (eg, end times) might reduce impact.

Citation: Van den Bulck J. Television viewing, computer game playing, and internet use and self-reported time to bed and time out of bed in secondary-school children. *SLEEP* 2004;27(1):101-4.

INTRODUCTION

UNTIL RECENTLY, THERE WAS LITTLE RESEARCH ABOUT THE IMPACT OF MEDIA USE ON CHILDREN'S SLEEPING BEHAVIORS. One early study found no relationship between television viewing and sleep duration.¹ A more recent study of 495 children between the ages of 4 and 10 years asked parents to answer questions regarding the sleeping behaviors of their children and found that television viewing and the presence of a television set in the child's bedroom were associated with sleep disturbances.² Parents, however, have been shown to be unreliable reporters of their children's behaviors because they will try to come across as "good parents." Issues dealing directly or indirectly with "good parenting" may elicit social-desirability effects in the answering patterns of the parents.^{3,4} Some authors conclude, therefore, that children's answers to survey questions are probably more reliable.^{5,6} Concerned parents, policy makers, or academicians have a tendency to worry most about the potential negative effects of television viewing. The world of entertainment media, however, is in full flux and changes quickly. One study linked sleeping disturbances to computer game playing⁷; another study linked interrupted sleep to children's possession of mobile phones.⁸ This suggests that one should no longer limit studies about the impact of the media to television use.

One explanatory hypothesis that has been put forward in previous research on the impact of television on sleep² is that television viewing

displaces sleep time, thus shortening sleep duration. Another study⁹ tried to explain this by drawing on Kubey's¹⁰ concept of "unstructured time" to hypothesize that people use television to fill "empty time" not used for more-organized activities, which include hobbies. Use of entertainment media can be categorized quite literally as "a residual category of leisure activity."¹¹ Unstructured activities are not automatically limited in time. They can expand and take up more time, whereas structured pastimes have fixed starting and stopping points. This suggests that unstructured activities are more likely to displace time than are structured activities. This seems to be supported by the same study that found that television viewing was correlated with going out, another way of filling unstructured time, but was not related to doing sports, a structured form of spending leisure time.⁹

The potential impact of the media on sleeping patterns is important. Sleep patterns change and develop constantly during adolescence.¹² Changes in sleep patterns have been linked to numerous problems, including daytime sleepiness,¹³ behavior problems,¹⁴ and even accidents.¹⁵

The present study is an attempt to add to our knowledge of the relationship between media use and sleep patterns in 4 ways: first, by looking at older children (in a representative sample of first- and fourth-year students at Flemish secondary schools); second, by asking the children (instead of parents) to report on their sleeping behaviors and their media use; third, by looking at computer game playing and Internet use, as well as at television viewing; and fourth, by examining whether media are bigger displacers of sleep time than are structured leisure activities, such as doing sports, and unstructured leisure activities, such as going out, as has been hypothesized in previous research.

METHOD

Subjects

We used data from the Leuven Study on Media and Adolescent Health. These data were collected by means of a standardized self-

Disclosure Statement

This study received a subsidy from the Ministry of Welfare of the Flemish Government in Belgium.

Submitted for publication August 2003

Accepted for publication September 2003

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administered questionnaire. Respondents were selected from a representative sample of first- and fourth-year students in 15 secondary schools in the Flemish Community of Belgium. The study was presented as an omnibus study on the leisure habits of Flemish youngsters and took place in an assembly setting. Research assistants were present to answer any questions.

The total sample size was 3000, but inaccurate information from the schools, sickness, truancy, and refusal to cooperate led to a final sample size of 2546 adolescents. First-year students, mean age 13.16 years (SD = .43 years) comprised 50.2% of the sample. The average age in the fourth year was 16.37 years (SD = .71 years). Boys comprised 54.2% of the sample.

Measures

Media Use

General television-viewing levels were estimated by giving the respondents a time line beginning at 7 AM and ending at 1 AM. They were asked to mark each half hour of the day in which they usually watched television. There were 7 time lines, 1 for each day of the week. The answers were summed to form an estimate of weekly viewing volume. Computer-game playing and Internet use were measured by asking how often the respondent played computer games and, in a separate question, how often they used the Internet. Answers were on a 7-point scale. Answer categories were 1, never; 2, once or twice a month; 3, once a week; 4, twice a week; 5, 3 times a week; 6, 4 times a week; and 7, more than 4 times a week. Next they were asked to indicate how many hours and minutes they played computer games on an average weekday, an average Friday, and an average weekend day. The same 3 questions were asked for Internet use. These variables were multiplied to obtain an estimate of average monthly game playing and internet use.

The respondents were asked whether they had a television set in their rooms, whether they had a computer game console in their rooms, and whether they had Internet access in their rooms.

Control Variables

These variables included study year (referred to as first or fourth year in the remainder of this article), age, and sex.

Activity Level

"Going out" was measured on a 6-point scale by asking respondents how often they went out (to taverns, pubs, bars, discos, parties, etc.): 1, never; 2, once or twice a year; 3, once or twice a month; 4, once a week;

5, several times a week; or 6, every day. Sports volume was measured the same way as computer game playing and Internet use by asking, first, how often they did sports apart from what they had to do at school and, second, how many hours or minutes they usually did sports during 1 session. These variables were multiplied to obtain an estimate of time spent doing sports on average each month.

Sleep Variables

In early studies looking at patients suffering from insomnia, it was shown that self-reports of sleep time underestimate the amount of sleep time, compared to accurate measurement methods such as laboratory observation and actigraphy.¹⁶ In recent research on average populations¹⁷ and on adolescents,¹⁸ however, it has been shown that sleep habits can be studied reliably by looking at self-reports. The respondents in our study were asked to indicate at what time they usually went to bed on an average weekday (Monday to Thursday) and on an average weekend day (Friday to Sunday). They were asked how late they got up on an ordinary weekday (Monday to Friday) and on an average weekend day (Saturday and Sunday). For the statistical analysis, number of minutes was divided by 60 and multiplied by 100 and added to the number of hours to obtain a metric variable. Hours were counted not in AM and PM but from 0 to 24. Hours after midnight were counted as 25 (for 1 AM), 26 (for 2 AM), etc, for "time of going to bed" variables. Respondents were asked to indicate how tired they felt at certain moments on an 11-point scale ranging from -5 (not tired at all) to +5 (very tired), with 0 as a neutral middle. The 5 situations were "How tired are you . . ." (1) "usually?" (2) "in the morning when you get up?" (3) "at school?" (4) "after a day at school?" and (5) "after the weekend?" A principal components factor analysis showed that these 5 indicators loaded on a single factor (eigenvalue: 2.459; explained variance 49.2%; Cronbach's α : .73). Factor scores were saved to create a "Tiredness" factor with a mean of 0 and a SD of ± 1 .

Statistical Analysis

All analyses were conducted using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, Ill, USA).

RESULTS

Media Use

A categorical variable was made by combining sex and grade. Mean data and SD for the media-use variables were computed for sex and grade, and a 1-way analysis of variance was conducted to analyze whether media use differed significantly for grade and/or sex by means of a posthoc Tukey test, which tests whether the means for the values of the independent variable differ at the $P < .05$ level. Table 1 shows that boys reported watching significantly more television than girls did. This was true in both years' students, even though first-year students reported that they watch significantly more television than fourth-year students did. There was no significant difference between first-year and fourth-year boys as far as playing computer games was concerned. Both reported playing significantly more than either first- or fourth-year girls. Girls rarely played computer games, but fourth-year girls reported playing significantly less than did first-year girls. There were no differences between boys and girls as far as Internet use was concerned, but fourth-year students reported using the Internet a lot more than did first-year students.

Activity level

Table 1 shows that there was no difference between first-year boys and girls regarding going out. First-year students

Table 1

	First year		Fourth year	
	Boys	Girls	Boys	Girls
Television viewing, h/wk	25 (12) ^a	21 (10) ^b	23 (11) ^c	19 (11) ^d
Computer game playing, h/mo	27 (32) ^a	8 (14) ^b	27 (32) ^a	4(13) ^c
Internet use, h/mo	19 (29) ^a	20 (28) ^a	31 (34) ^b	31 (34) ^b
Going out*	2.1 (1.1) ^a	2.0 (1.0) ^a	3.4 (1.3) ^b	3.1 (1.2) ^c
Sports, h/mo	21 (20) ^a	13 (14) ^b	19 (19) ^a	13 (16) ^b
Bedtime weekdays†	21:33 (0:45) ^a	21:34 (0:46) ^a	22:36 (0:54) ^b	22:24 (0:45) ^c
Getting up weekdays†	6:55 (0:22) ^{ab}	6:55 (0:24) ^{ab}	6:58 (0:28) ^b	6:51 (0:26) ^a
Bedtime weekend†	23:06 (1:23) ^a	22:49 (1:07) ^b	03:43 (2:02) ^c	00:10 (1:54) ^d
Getting up weekend†	9:36 (1:32) ^a	9:42 (1:19) ^a	10:16 (1:43) ^b	10:10 (1:26) ^b
Total sleep weekdays, h:min	9:23 (0:45) ^a	9:21 (0:52) ^a	8:22 (0:58) ^b	8:38 (0:50) ^c
Total sleep weekend, h:min	10:29 (1:33) ^a	10:55 (1:18) ^b	9:36 (1:42) ^c	10:00 (1:36) ^b
Tiredness‡	-0.25 (1.01) ^a	-0.11 (0.99) ^a	0.17 (0.97) ^b	0.27 (0.92) ^b

Data are presented as mean (SD). Means without the same letter across rows differ at the $P < .05$ level (Tukey test).

First year: first year of secondary school (average age, 13 years); Fourth year: fourth year of secondary school (average age, 16 years).

*6-point scale: 1-6.

†Time is expressed in 24-hour clock time.

‡Tiredness: mean = 0, SD = 1. Values therefore express deviation from the mean.

differed significantly from fourth-year students. The latter reported going out more. Fourth-year boys reported going out significantly more than did fourth-year girls. Girls reported spending significantly less time doing sports than boys did, but there was no difference between the grades, for either boys or for girls.

Sleeping Variables

First-year students went to bed at around 9:30 PM during the week. Fourth-year students went to bed about an hour later, but boys went to bed significantly later than girls did. On average, all respondents got up at around 7 AM on weekdays, but fourth-year girls got up slightly earlier than did fourth-year boys. All 4 groups differed significantly with regard to going to bed on weekend evenings. First-year girls went to bed earliest (at about 10:50 PM), followed by first-year boys (11:06 PM). Next came fourth-year girls, at about 0:10 AM. The difference for fourth-year boys was large; they went to bed, on average, at 3:45 AM. This late average bedtime was caused by 10.1% of fourth-year boys who reported going to bed after 2 AM; 75.4% of them reported being in bed by midnight. First-year students got up a little before 9:45 AM on weekend days. Fourth-year boys got up at 10:16 AM, which differed significantly from fourth-year girls who got up at 10:10 AM. On weekdays, first-year students were in bed for a little less than 9.5 hours. Fourth-year boys reported being in bed for 8 hours and 22 minutes, while fourth-grade girls were in bed about a quarter of an hour longer. On weekend days, first-year boys spent about 10.5 hours in bed, while first-year girls spend about 11 hours in bed. Fourth-year girls spend about 10 hours in bed, which was significantly more than the 9.5 hours of the fourth-year boys. Levels of overall tiredness differed only significantly between grades, with first-year students less tired than average and fourth-year students more tired than average.

Media in Children's Rooms

Thirty-five percent of the first-year boys had their own television set in their room; 23.5 % of the first-year girls had one. Among the fourth-year students, 43.9 % of the boys had a television set as opposed to 28.1% of the girls. Of the first-year students, 38.1% of boys had a computer capable of playing computer games or a game console in their room versus 21.1% of the girls. Among the fourth-year students, 43.7% of the boys could play computer games in their room, as could 21.5% of the girls. Only .03% of the first-year boys and .02% of the first-year girls

had Internet access in their room. None of the fourth-year students in the sample had Internet access in their own room. This variable was therefore dropped from the rest of the analyses.

Association of Media Use and Sleep Patterns

Table 2 shows the results of hierarchical multiple-regression analyses in which 4 blocks of variables were entered. The first block consisted of the traditional demographic control variables of sex and age. The correlation between grade and age was $r = .94$ ($P < .0001$), so only age was entered into the analyses to avoid obvious co-linearity problems. The second block consisted of unstructured and structured leisure-time activities (going out and doing sports, respectively). The third block consisted of structural media variables, notably presence of a television set and of a gaming computer in the child's bedroom. The fourth and final block consisted of 3 media-use variables: total television-viewing volume (hours per week), total computer game playing (hours per month), and total internet use (hours per month).

Respondents who reported they went out more, went to bed significantly later on weekdays and on weekend days, got up significantly later on weekend days, spent significantly less time in bed on weekdays and weekend days, and were significantly more tired. Doing sports was only significantly related to overall level of tiredness, with respondents who did more sports less tired than those who did fewer sports.

Children with a television set in their room went to bed significantly later on weekdays and weekend days and got up significantly later on weekend days. Overall, they spent less time in bed on weekdays. Children with a gaming computer in their room went to bed significantly later on weekdays. On weekdays, they spent significantly less time in bed.

Children who were more-frequent television viewers went to bed later on weekdays and weekend days and got up later on weekend days. They spent less time in bed on weekdays. They reported higher overall levels of being tired. Children who played more computer games went to bed later on weekdays and weekend days and got up later on weekend days. On weekdays, they actually got up significantly earlier. They spent less time in bed on weekdays and reported higher levels of tiredness. Children who used the Internet more often went to bed significantly later during the week and during the weekend. They got up later on weekend days. They spent less time in bed during the week and reported higher levels of tiredness.

Table 2—Results of the General Linear Model for Dependent Variables

	Weekdays				Weekends				Total hours in bed				Overall level of tiredness	
	Time in bed β	R ² change	Time up β	R ² change	Time in bed β	R ² change	Time up β	R ² change	Weekdays β	R ² change	Weekend β	R ² change	β	R ² change
Control variables		.259†		.003*		.262†		.061†		.232†		.108†		.049†
Sex	-.018		-.076†		-.020		.073†		-.017		.098†		.066†	
Age	.371†		-.005		.281†		.109†		-.352†		-.198†		.145†	
Activity variables		.048†		.000		.150†		.066†		.044†		.032†		.024†
Going out	.191†		.013		.401†		.247†		-.182†		-.202†		.149†	
Sports per month	.001		.011		-.020		-.040		.009		.000		-.082†	
Media in room		.018†		.002		.020†		.018†		.021†		.001		.001
TV	.097†		-.004		.092†		.082†		-.099†		-.022		-.049	
Gaming computer	.027		-.042		.049*		.045		-.046*		-.014		-.002	
Media use		.030†		.004		.014†		.018†		.023†		.000		.015†
TV	.067†		.047		.089†		.097†		-.041*		-.008		.076†	
Computer games	.052*		-.053*		.055†		.059*		-.064†		-.006		.056*	
Internet use	.138†		.033		.038*		.055*		-.119†		.012		.060*	
Model mean square	64.474		.389		306.191		82.529		64.108		78.936		18.328	
Model F	115.512		1.975		168.110		40.701		48.248		34.602		19.991	
df	9.1884		9.1884		9.1884		9.1884		9.1884		9.1884		9.1874	
Model R ²	.36†		.01*		.45†		.16†		.32†		.14†		.09†	

Values for variables are standardized β
Significance: * $P < .05$ † $P < .001$ ‡ $P < .0001$

DISCUSSION

This study found evidence of a statistically significant relationship between 3 media-use variables and sleep patterns. Overall, the conclusion appears to be that television viewing, computer game playing, and internet use all lead to getting to bed later and to spending less time in bed. Interestingly, these variables were not positively related to spending more time in bed during the weekends. Earlier research had shown that losing sleep during the week and going to bed later on weekends tended to be related to sleeping longer during the weekend, as a kind of compensatory behavior.¹² In our study, media use did lead to delayed time in bed but did not seem to lead to compensatory behavior. As such, the lack of sleep that was induced by media use may be cumulative. Interestingly, going out also led to going to bed later on weekdays and weekend days and getting up later on weekend days and did not lead to compensatory behavior either. It led to less time in bed on weekdays and weekend days and to an increase in overall tiredness. Children who had a television set in their rooms appeared to get less sleep on weekdays, even though having a television set did not appear to be related to higher self-reported tiredness. The relationship was similar but less strong for those children having a gaming computer in their room.

Television viewing has been defined as a means to pass “unstructured time.” By extension, this definition applies to use of all entertainment media. People use the entertainment media as a means to fill spare time. As such, it has to be distinguished from structured pastimes such as hobbies or doing sports. While media use was linked to going to bed later and to spending less time in bed in this study, the use of 2 other indicators of leisure activity allowed us to put the media variables into perspective. Structured pastimes, such as doing sports, had no or only a small and positive relationship with time in bed. Almost by definition, structured pastimes are unlikely to compete with sleep because they start and end at set times. The unstructured pastime measured in this study, going out, on the other hand, was strongly related to spending less time in bed or going to bed later.

CONCLUSION

The findings of this study lead to a number of conclusions. First, the study shows that, in the present day and age, it no longer suffices to worry about only television viewing. Other media play an equally important part in the lives of young people and can have a very similar impact. Second, it shows that media use is associated with sleep patterns in a negative way. It is important to realize that both the use of media (viewing television, playing games, or using the Internet) and more structural elements such as presence of media appliances in a child's bedroom can be indicators of disturbed sleep patterns. Third, the results lead to the hypothesis that the problem with media use is that it is a form of unstructured use of leisure time. Doing sports or other ways to spend time in a structured way have clear starting and ending points, which unstructured activities such as media use or going out do not have. The present findings, therefore, suggests that structured activities are less likely to displace sleep time, while unstructured activities (of which media use is but 1 example, as the going-out variable illustrates) are more likely to displace sleep time. Fourth, while previous research had found that reduced time in bed during the week leads to compensatory behavior during the weekend, the present study showed that this is not true for unstructured activities.

Finally, the similarity between the correlates of media use and time-in-bed variables on the one hand and the relationship between those same sleep-related variables and going out on the other hand, suggest hypotheses for dealing with the impact of such activities on sleep patterns. The present study suggests that it would be worth studying whether the negative impact of such activities can be curtailed by structuring them, ie, by imposing restraints regarding how late children are allowed to view television, play computer games, use the Internet, or go out.

ACKNOWLEDGMENT

This study was funded by a subsidy from the Ministry of Welfare of the Flemish Government.

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