

TV exposure associated with sleep disturbances in 5- to 6-year-old children

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SUMMARY The aim of this study was to investigate the effects of various forms of TV exposure on the quality of children's sleep. In this randomized population-based survey questionnaires concerning TV viewing, sleep disturbances, and psychiatric symptoms were administered to 321 parents of children aged 5–6 years. Sleep disturbance scores were the main outcome measures. Active TV viewing and passive TV exposure were related to sleeping difficulties, especially sleep–wake transition disorders and overall sleep disturbances. Particularly, passive TV exposure and viewing adult-targeted TV programs were strongly related to sleep disturbances. The association remained significant when socioeconomic status, family income, family conflicts, the father's work schedule, and the child's psychiatric symptoms were controlled statistically. The adjusted odds ratios were 2.91 (95% CI 1.03–8.17) and 3.01 (95% CI 1.13–8.05), respectively. TV viewing and particularly passive TV exposure and viewing adult-targeted programs significantly increase the risk of sleeping difficulties. The results suggest that health-care professionals should be aware of the association between TV exposure and sleep disturbances.

KEYWORDS children, passive TV viewing, sleep disturbances, TV exposure, TV viewing

INTRODUCTION

TV viewing takes up a large part of children's waking time in Western industrial countries. According to a European comparative study, the proportion of television users among children aged 9–16 ranges from 98% to 100% (Beentjes *et al.*, 2001). In Western countries, such as the USA, Canada, and the European countries children in this age group spend on average 2.2 h day⁻¹ watching TV (in Finland 2.3 h day⁻¹) making approximately 15.4 h week⁻¹ (Beentjes *et al.*, 2001). Moreover, among 3- to 10-year-old children in Canada the average TV viewing time was 14 h week⁻¹ (Bernard-Bonnin *et al.*, 1991) and among 4- to 10-year-old children in New England (USA) the average TV viewing time was about 16.3 h week⁻¹ (Owens *et al.*, 1999).

TV viewing is also common in the youngest age groups. According to Wright *et al.* (2001) 3- to 5-year-old children watch TV on average 13.8 h week⁻¹, and 6- to 8-year-olds 13.5 h week⁻¹. A more recent study reported TV viewing hours ranging from 6.3 to 9.1 h week⁻¹ among children aged 0–6 years (Vandewater *et al.*, 2005). Secondary TV viewing (viewing that accompanied another activity) has also been found to be prevalent among young children, peaking in the age of 3–5 years, being 1.5 h week⁻¹ on average (Wright *et al.*, 2001). As many as 35% of the children live in a home where the television is on most of the time (Vandewater *et al.*, 2005). However, not much is known about the impact of background TV on children's development (Anderson and Evans, 2001).

On the other hand, the impact of TV viewing on children's wellbeing and health is widely recognized and considered a serious problem in modern societies. The negative effects of TV have been thoroughly summarized in recent reviews (Anderson *et al.*, 2003; McIlhaney, 2005; Strasburger and Donnerstein, 1999; Villani, 2001). Excessive TV viewing has, for

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example, been associated with many psychiatric symptoms, such as aggressive behavior (Johnson *et al.*, 2002; Robinson *et al.*, 2001; Singer *et al.*, 1998), social problems (Ozmert *et al.*, 2002), family interaction problems (Bernard-Bonnin *et al.*, 1991), and attentional problems and hyperactivity (Christakis *et al.*, 2004b; Ozmert *et al.*, 2002). Television programs also provoke fears in young children (Cantor, 1998; Lahikainen *et al.*, 2003; Valkenburg *et al.*, 2000). Links have been suggested with certain somatic problems (Toyran *et al.*, 2002) and obesity (Robinson, 2001). Violent content in TV programs causes aggressiveness, behavioral problems, and attentional problems (Singer *et al.*, 1998). Only a few studies have assessed the effects of TV viewing on children's sleep quality even though sleep and psychiatric symptoms are known to be closely intertwined (Paavonen, 2004).

More than 20 years ago, no relationship between TV viewing and sleep length was found (Weissbluth *et al.*, 1981). The more recent studies have, however, showed that many TV viewing habits affect children's sleep quality (Johnson *et al.*, 2004; Owens *et al.*, 1999; Van den Bulck, 2004). Owens *et al.* (1999) reported that TV viewing is associated with sleeping difficulties, bedtime resistance, sleep-onset delay, sleep anxiety, night wakings, and shortened sleep duration. Van den Bulck (2004) similarly found that heavy TV exposure is associated with shortened sleep length. Especially those children who had a television set in their rooms slept less than other children (Van den Bulck, 2004). Finally, Johnson *et al.* (2004) found that watching television three or more hours per day during adolescence elevated risk for frequent sleep problems by early adulthood.

These findings suggest that media exposure can shorten children's sleep and impair the sleep quality both short-term and long-term. As sleep is essential to children's development and health, the negative effects of TV viewing may be a significant concern (Owens, 2004). However, many important questions concerning the impact of TV viewing on sleep still remain largely uncovered. Especially the influence of program content and passive TV exposure have not been previously investigated. Moreover, the youngest age groups have not usually been studied, even though they are likely to be most vulnerable to the negative effects of TV, because younger children's abstract reasoning skills have not yet developed and therefore they cannot discriminate between fantasy and reality (Rich and Bar-on, 2001). The need for new research is further emphasized by the changes in program contents and by the increasing TV exposure. In a recent statement, content analysis was specifically suggested to be one central goal for future media research (Brown and Cantor, 2000).

The present study explores the relationship between TV viewing and sleeping difficulties among children aged 5–6. Our basic hypothesis is that there is a significant positive connection between the amount of passive TV exposure, active TV viewing, and sleep disturbances. However, we assume that the effect of TV is dependent on the program content, in that adult content is most deleterious.

METHODS

Sample

A population-based random sample was collected in three University cities in Finland. First, a random sample of families in the target area with children of target age was drawn by the Population Register Centre, Finland. The sampling frame consisted of 428 children born between 1 January 1997 and 31 December 1998, representing the typical urban population of 5- to 6-year-old children. Second, an information letter was sent to all parents, who were then contacted by phone to determine whether they are willing to participate. It was made clear that participation was voluntary. We failed to reach 64 of the families by phone and 33 families refused to participate. The exclusion criteria were defined *ex ante*, with a purpose to exclude those parents with insufficient language skills or those parents and children with severe participation/co-operation problems. Ten cases were excluded from the study for the following reasons: (1) child's severe handicap ($n = 3$), (2) parents poor/no knowledge of Finnish ($n = 3$), (3) severe parental alcohol problems ($n = 1$) and (4) moving out of town ($n = 3$). Questionnaires were thus taken or sent to 321 parents. Twenty-four cases did not return the questionnaires despite requests. Hence, we had a total of 297 consenting families giving a response rate of 81.6%.

Measures

The TV questionnaire included 34 items concerning the overall time that the TV was switched on in the household, the time that the TV was on while the child in concern was awake, and the amount of the child's active TV viewing. Weekdays and weekends were considered separately. There were 17 statements concerning TV viewing practices (viewed program categories, co-viewing, viewing-contexts, video viewing and television-related experiences). All these items were rated on a five-point scale ('never', 'occasionally = less than 1–2 times a month', 'sometimes = 1–2 times a week', 'often = 3–5 times a week,' and 'always = daily'). Children's active TV viewing and passive exposure to TV programs were assessed separately. TV viewing of adult programs refers to children's active viewing of adult-targeted TV programs (such as police series, movies, TV series, current affairs programs). The parents also filled in a previously validated sleep disturbance questionnaire with 26 items rated on a five-point scale (Bruni *et al.*, 1996). The questionnaire includes questions on sleep duration and sleep latency, as well as questions on various sleep disturbances. Six subscale scores (DIMS, disorders of initiating and maintaining sleep; SBD, sleep breathing disorders; DA, disorders of arousal; SWTD, sleep-wake transition disorders; DES, disorders of excessive somnolence; SHY, sleep hyperhydrosis) and a total score (sleep problem severity score) were gathered. The psychiatric symptoms were assessed using the Children's Behavior Checklist for parents (CBCL) (Achenbach, 1991). In addition, a large amount of background information on

socioeconomic status (SES), family financial situation, and family life was collected.

Data analysis

Weekly TV viewing in the family was summarized from items representing the amount of time that the TV is switched on in the household overall or when the child is awake during weekdays and weekends (5*weekday + 2*weekend). Similarly, the amount of time that the child spent actively watching TV during the week was summarized from items representing the amount of TV viewing during weekdays and weekends. Passive TV exposure was defined as meaning that 'the child does not pay active attention and is not the one for whom the content is intended'. The term was operationalized as the amount of time that the TV is on at the child's home when she/he is awake but not actively watching. Anderson and Evans (2001) have used the term background exposure referring to similar effects of media exposure (Anderson and Evans, 2001).

To assess the connection between sleep disorder scores and TV viewing, all variables were categorized at the 75th percentile (the variable representing the amount of time the TV is on when the child is awake at 25.0 h, amount of active TV viewing at 11.6 h, and amount of passive TV exposure at 15.0 h). This cut-off point was selected because graphical analysis indicated that children in this category have significantly more psychiatric symptoms and sleeping difficulties than those with lesser amounts of TV exposure. Four outliers were excluded from all the analyses because of a probable error in filling out the questionnaire. All these cases had reported that the child's TV viewing time would be 80–120 h week⁻¹.

Maximum likelihood factor analysis was performed to reduce the number of items concerning TV viewing practices and to construct composite scales that described children's TV viewing characteristics. All variables describing TV viewing practices on a scale from 1 to 5 were included. The final factor pattern consisted of three descriptive factors representing (F1)

parent-involved TV viewing, (F2) active viewing of adult TV programs, and (F3) TV viewing while eating/going to bed (Table 1). The factors explained 57.4% of the total variance in the data. The factor scores were calculated using the regression method and were used in the further statistical analyses.

Summary data are represented as mean \pm 95% standard deviation, or in the case of categorical variables as percentages. To assess relationships between sleep quality and TV viewing, Pearson's or Spearman's correlation coefficients were calculated for both the factors score variables and the separate items of TV viewing practices. Mean sleep problem scores were compared in groups with low and high TV exposure using the *t*-test or Mann–Whitney *U*-test. The non-parametric test was used when the variables were ordinal and/or not normally distributed. To assess risk for sleep problems, odds ratios with 95% confidence intervals were calculated.

Finally, a series of logistic regression models were generated to assess which of the TV variables were related to the deviant sleep problem severity score when significant background factors (socioeconomic class, child's psychiatric symptoms, and gender) were controlled statistically. The categorized sleep score variables served as the main outcome variables. The previously defined cut-off (75th percentile) was selected, because it was both conceptually reasonable and theoretically acceptable (Rodrigues and Kirkwood, 1990). Additional confounding factors were selected into the regression analysis on the basis of their associations with the variables to be explained and the independent variables. Children's somatic health and parents' marital conflicts were associated with sleeping difficulties but not active TV viewing/passive TV exposure, while mother's and father's SES, mother's work schedule, the children's day-care arrangements and children's psychiatric symptoms were associated with active TV viewing/passive TV exposure but not sleep problems. Family conflicts, family income and the father's work schedule (regular/shift work or irregular work/unoccupied) were significantly associated with both the amount of active TV viewing/passive TV exposure and the sleeping difficulties. Hence family conflicts,

Table 1 Factor structure of 5- to 6-year-old children's TV viewing practices evaluated by parents (rotated factor solution)

Factors	F1 (Parent-involved TV viewing)	F2 (Active viewing of adult programs)	F3 (TV viewing while eating/at bedtime)	Communality
Variables				
1. Parents discuss about TV programs	0.91	0.09	0.01	0.83
2. Child asks about TV programs	0.86	0.07	0.13	0.76
3. Parental co-viewing	0.46	0.24	0.06	0.28
4. The child watches police series	0.06	0.71	0.07	0.51
5. The child watches adult movies	0.08	0.58	0.06	0.35
6. The child watches adult TV series	0.07	0.58	0.05	0.34
7. The child watches current affairs programs	0.24	0.39	-0.07	0.22
8. The child watches TV while eating	0.08	0.02	0.52	0.28
9. The child watches videos	0.03	-0.04	0.53	0.28
10. Bedtime viewing	0.01	0.12	0.49	0.25
Eigenvalues of the factors	2.67	1.57	1.50	
% of variance explained	26.71	15.69	14.98	
Cumulative % of variance explained	26.71	42.40	57.38	

Table 2 Means of sleep problem scores in groups of low and high active TV viewing and of low and high passive TV exposure (*t*-test or Mann-Whitney *U*-test)

Groups	Low active TV viewing*	High active TV viewing	<i>P</i>	Low passive TV exposure†	High passive TV exposure	<i>P</i>
Disorders of initiating and maintaining sleep (DIMS)	10.69 (2.72)	10.37 (2.27)	0.37	10.34 (2.40)	11.53 (3.05)	0.01‡
Sleep breathing disorders (SBD)	3.65 (0.91)	3.80 (1.15)	0.26	3.67 (0.92)	3.73 (1.14)	0.69
Disorders of arousal (DA)	3.64 (0.86)	3.80 (0.87)	0.16	3.66 (0.86)	3.71 (0.89)	0.67
Sleep wake transition disorders (SWTD)	8.58 (2.15)	9.24 (2.42)	0.03‡	8.56 (2.14)	9.24 (2.42)	0.03‡
Disorders of excessive somnolence (DES)	6.79 (1.53)	7.24 (1.78)	0.04‡	6.81 (1.56)	7.08 (1.64)	0.23
Sleep hyperhydrosis (SHY)	2.83 (1.44)	2.89 (1.49)	0.77	2.76 (1.35)	3.03 (1.65)	0.19
Sleep problem severity score	36.14 (5.80)	37.15 (6.38)	0.22	35.71 (5.49)	38.32 (6.58)	< 0.01‡

Values are given as mean (SD).

*Children in the low TV active viewing group watched TV less than 11.6 h week⁻¹, while children in the high TV viewing group watched more than 11.6 h week⁻¹.

†Children in the low passive TV exposure group were exposed to TV programs less than 15.0 h week⁻¹, while children in the high passive TV exposure group were exposed more than 15.0 h week⁻¹.

‡*t*-test.

family income and the father's work schedule were also controlled in the models. Finally, a series of models were constructed to detect interactions between the main independent variables. All two-way interactions were considered, and an interaction term was included in the model if it reached statistical significance.

RESULTS

There were 138 (46.8%) girls and 157 (53.2%) boys in the sample. Regarding SES, 36.8% of the mothers and 51.3% of the fathers were in the lowest SES group (had not graduated from senior high school), 35.1% of the mothers and 21.0% of the fathers were in the intermediate group (some lower qualifications or matriculation examination only) and 28.1% of the mothers and 27.7% of the fathers were in the highest SES group (academic degree). In terms of ethnic background, all the children were white Europeans with the exception of one Asian child and two Arabian children.

On average, the TV was switched on for 29.1 ± 11.9 h week⁻¹ (4.2 h day⁻¹). The range was 5.5–84.0 h week⁻¹. During the child's waking hours, the TV was on for 19.9 ± 9.0 h week⁻¹ (2.8 h day⁻¹), the range being 3.5–54.0 h week⁻¹. Children watched actively TV 10.1 ± 3.7 h week⁻¹ (1.4 h day⁻¹), varying from 2.5 to 29.0 h week⁻¹. Exposure to passive TV was 9.8 ± 7.6 h week⁻¹ (1.4 h day⁻¹, range 0.0–38.5 h week⁻¹).

The amount of time that the TV was switched on in the household when the child was awake, the amount of active TV viewing, and exposure to passive TV were correlated with decreased total sleep duration ($r = 0.18$, $P < 0.01$; $r = 0.15$, $P = 0.02$ and $r = 0.16$, $P = 0.01$, respectively). Active TV viewing was correlated with SWTD ($r = 0.18$, $P = 0.02$). Passive TV exposure was correlated with DIMS ($r = 0.11$, $P = 0.05$), SWTD ($r = 0.16$, $P = 0.01$) and the sleep problem severity score ($r = 0.15$, $P = 0.01$). Respectively, the sleep problem scores differed between children from families with low versus high TV exposure (Table 2, Fig. 1).

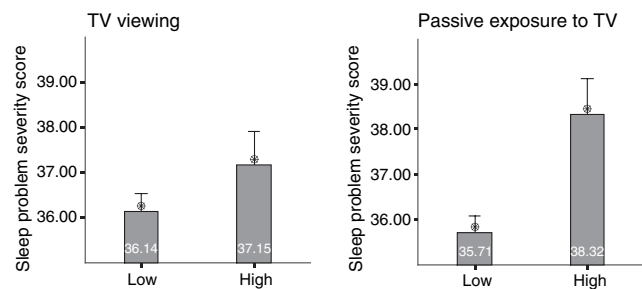


Figure 1. Mean sleep problem severity scores in children with low and high active TV viewing (dichotomized at 11.6 h week⁻¹) and passive exposure to TV (dichotomized at 15.0 h week⁻¹). The error bars represent the standard error of mean.

Moreover, children with high sleep problem severity scores had different TV viewing habits than others: they were from such families in which the TV tended to be switched on for longer (19.01 h week⁻¹ versus 22.82 h week⁻¹, $P < 0.01$) and the amount of passive TV exposure higher (9.13 h week⁻¹ versus 12.34 h week⁻¹, $P < 0.01$).

Different TV viewing practices were also associated with sleep problems; watching TV alone was correlated with DIMS ($r = 0.16$, $P = 0.05$), and watching TV at bedtime with SWTD ($r = 0.19$, $P < 0.01$), DES ($r = 0.13$, $P = 0.03$), and the sleep problem severity score ($r = 0.19$, $P < 0.01$). The mean sleep problem severity score was also significantly higher in children with more frequent TV viewing at bedtime ($P < 0.001$, Fig. 2).

There was also a clear association between the contents of actively viewed TV programs and the sleep problem scores. Watching current affairs programs was significantly correlated with SWTD ($r = 0.25$, $P < 0.01$), SHY ($r = 0.14$, $P = 0.06$), and the sleep problem severity score ($r = 0.16$, $P = 0.03$); adult movies with DIMS ($r = 0.13$, $P < 0.08$), SWTD ($r = 0.15$, $P = 0.04$), SHY ($r = 0.13$, $P = 0.09$), and the sleep problem severity score ($r = 0.19$, $P = 0.01$); adult series with SWTD ($r = 0.21$, $P < 0.01$), and the sleep problem severity

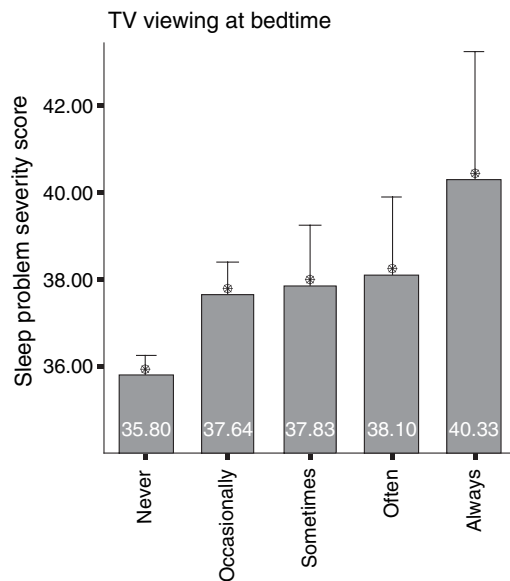


Figure 2. Mean sleep problem severity scores in children with different frequency of TV viewing at bedtime. The error bars represent the standard error of mean.

score ($r = 0.14$, $P = 0.05$); and police series with SWTD ($r = 0.15$, $P = 0.04$), DES ($r = 0.18$, $P < 0.01$), SHY ($r = 0.18$, $P = 0.01$), and the sleep problem severity score ($r = 0.19$, $P = 0.01$) (Table 3). Active viewing of adult TV programs, except sports was consistently correlated with most of the sleep subscale scores (Fig. 3).

Statistical models further demonstrated that high exposure to adult TV programs and passive TV exposure were significantly associated with sleep problems (Table 4). There was also an almost significant interaction between passive TV exposure and active viewing of adult programs [adjusted odds ratio (AOR) 10.14, 95% CI 0.81–127.04, $P = 0.07$]. By contrast, active TV viewing time and the viewing of children's programs were not related to sleep problems.

DISCUSSION

In this study, we examined the effects of TV viewing on children's sleep. In concordance with previous studies (Johnson *et al.*, 2004; Owens *et al.*, 1999; Van den Bulck, 2004), we

found that TV viewing was related to various sleeping difficulties and decreased sleep length. Certain TV viewing practices, such as watching TV alone, watching TV at bedtime, and active viewing of adult TV programs were also related to sleeping difficulties. Moreover, both the amount of time the TV was switched on in the family and the quantity of passive TV exposure were significantly associated with children's sleeping difficulties, especially sleep onset problems and sleep-wake transition disorders.

The variety of age ranges of children in studies concerning TV consumption makes it difficult to compare results of different studies. It seems, however, that the average amount of active TV viewing time is lower in our study than in previous studies concerning older school age children (according to Beentjes *et al.* 9–16-year-olds watched 15.4 h week⁻¹, according to Owens *et al.* 4–10-year-olds watched 16.3 h week⁻¹ and according to Bernard-Bonnin *et al.* 3–10-year-olds watched approximately 14 h week⁻¹) but higher than reported in the study concerning younger children (0–6 years, 6.3–9.1 h week⁻¹) (Beentjes *et al.*, 2001; Bernard-Bonnin *et al.*, 1991; Owens, 2004; Vandewater *et al.*, 2005).

In contrast to Owens' findings and our hypothesis, we could not establish a clear link between the quantity of children's active TV viewing, as reported by their parents, and the indicators of sleep problems after controlling for the background factors in the multivariate models. While our sample was very homogeneous with respect to age (5–6 years), the sample studied by Owens *et al.* included children over a large age-range (4–10 years), which may go some way toward explaining this discrepancy as it is likely that the effects of both active TV viewing and passive TV exposure are largely age-dependent. Furthermore, it is important to note that the average TV viewing time was clearly higher in the Owens' study than in our study (16 h week⁻¹ versus 10 h week⁻¹) which also very likely reflects the differences in the age groups studied. It is clear that the content of TV programs viewed varies between different ages. Viewing 'more harmful' adult-targeted programs probably increases with age, while younger children are likely to prefer 'more benign' children's programs. Older children are also likely to have more autonomy in TV viewing than younger children (Strasburger and Donnerstein, 1999), which suggests they may have access to contents that are not age-adequate. We conclude that the dissimilarities

	Parent-involved TV viewing	Viewing adult programs	TV viewing while eating/at bedtime
Disorders of initiating and maintaining sleep	-0.03 (0.96)	0.03 (0.64)	0.07 (0.26)
Sleep breathing disorders	0.05 (0.45)	0.14 (0.02)	0.02 (0.72)
Disorders of arousal	0.10 (0.10)	0.15 (0.01)	0.06 (0.28)
Sleep wake transition disorders	0.05 (0.45)	0.21 (0.01)	0.18 (<0.01)
Disorders of excessive somnolence	-0.07 (0.22)	0.16 (0.01)	0.10 (0.09)
Sleep hyperhydrosis	0.01 (0.83)	0.14 (0.02)	0.03 (0.63)
Sleep problem severity score	0.02 (0.72)	0.20 (0.01)	0.14 (0.02)

Values are given as r (P).

Table 3 Correlations of TV viewing practices with the sleep problems (Pearson's correlation coefficient)

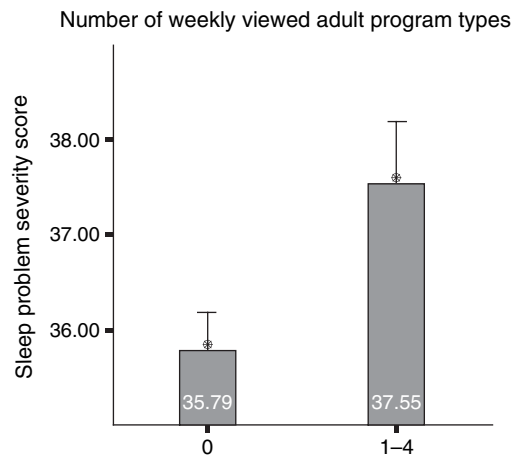


Figure 3. Mean sleep problem severity scores in children with no adult program exposure and others. The error bars represent the standard error of mean.

between Owens' findings and ours merely reflect differences in the age distributions of the study populations and their TV viewing habits and not actual differences in the effects of TV on sleep. However, it is important to note that we were able to confirm the results of the Owens' study concerning the association of bedtime viewing and sleep problems. Also in that study, bedtime viewing and use of television as sleep aid were connected with the greatest frequency of sleep disturbances. Finally, it is worth noting that Weissbluth's findings 20 years ago are also in contrast to Owens' results. In that study, TV viewing was reported to have no association on children's sleep (Weissbluth *et al.*, 1981). It is therefore possible that the discrepancies between these findings reflect actual changes in children's TV viewing practices during the last 20 years.

The novel and important finding of our study was the link observed between passive TV exposure and sleeping difficulties. High exposure to passive TV clearly increased the risk for sleep problems (AOR 2.91) and there was also a significant interaction effect between simultaneous exposure for both adult programs and passive TV (AOR 10.14). Passive TV exposure can therefore be particularly harmful to young children. Rather surprisingly, the effects of exposure to passive TV have not received previously very much research attention (Anderson and Evans, 2001). The harmful effects of passive TV exposure may be an outcome of several factors:

1. There are differences in the contents of programs passively and actively viewed. Passive TV exposure increases the risk of children coming into contact with violent program contents, for instance, while the contents of active viewing are probably more often controlled by parents. Violence on TV is considered a major concern (American Academy of Pediatrics Committee on Public Education, 2001; Cantor, 2000).

2. Passive TV exposure can be harmful because the stimuli received are not under social and personal control. Especially children under 8 whose abstract reasoning skills have not yet developed, cannot discriminate between fantasy and reality, and may be therefore particularly vulnerable to direct influences of media (Rich and Bar-on, 2001).

3. It is possible that in families where the TV is kept on for long hours, the time parents actively spend with their children is diminished. For example, children from families with heavy TV exposure were less likely to be read to (Vandewater *et al.*, 2005). Such parental unavailability may result in reduced emotional responsiveness to the child's needs which may interfere with the child-parent attachment and is also reflected by the sleep disturbances found in this study. Furthermore, ineffective limit setting, considered as one etiology for sleeping difficulties in young children, might contribute to these findings in such circumstances.

4. Passive TV exposure may be a more reliable measure of TV exposure than the amount of children's active TV viewing, because parents tend to underreport the number of hours their offspring watch TV (Dietz and Strasburger, 1991). Moreover, studies comparing parents' and children's evaluations have shown a social desirability bias with regard to the content of programs, unsupervised television viewing, time and regulating children's viewing (Buckingham, 1996).

5. Passive TV exposure can also interfere with other important activities, such as playing or reading, which may have secondary negative effects on sleep that are reflected in increased rates of sleeping difficulties. Large quantities of TV viewing may also simply displace sleep time (Anderson and Evans, 2001; Owens *et al.*, 1999).

6. Some studies have shown that children's trauma symptoms are related to TV exposure (Singer *et al.*, 1995, 1998), and that post-traumatic stress disorder (PTSD) can exist after television programs (Simons and Silveira, 1994). Sleep disturbance, in turn, is traditionally considered a hallmark of PTSD.

Table 4 Television viewing practices and the risk for high sleep problem severity scores (logistic regression models)

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
TV on when child awake	2.16 (1.16–4.04)*	1.84 (0.66–5.13)
Passive TV exposure	2.53 (1.35–4.73)**	2.91 (1.03–8.17) [†]
Active TV viewing	1.62 (0.86–3.04)	1.04 (0.36–3.06)
Parent-involved TV viewing	1.31 (0.69–2.49)	0.81 (0.30–2.22)
Active viewing of adult programs	2.86 (1.55–5.27)**	3.01 (1.13–8.05) [†]
TV viewing while eating/at bedtime	1.57 (0.84–2.95)	2.09 (0.80–5.44)

All variables were dichotomized at the upper quartile. * $P < 0.05$, ** $P < 0.01$.

[†] $P < 0.05$ after controlling for background factors (family conflicts, family income, the father's work schedule, mother's socioeconomic class, gender, and psychiatric symptoms). The CBCL total t -score served as the measure for psychiatric symptoms.

As it was hypothesized in our study, the adult content of TV exposure was the most important predictive factor of sleeping problems in young children. Active viewing of adult programs significantly increased the risk for sleeping problems (AOR 3.0). The content of TV programs has previously been reported to affect children's behavior. For example, violence in TV programs caused behavioral and attentional problems (Singer *et al.*, 1998) and risk-taking behavior (Potts *et al.*, 1994) increased after exposure to TV programs with frequent physical risk taking.

The study examined a highly representative sample of an urban child population and it had a high response rate. However, one limitation in the study is related to the measurement of passive TV exposure: a true assessment of exposure would require that the child concerned could actually watch or listen to the TV programs, but for practical reasons this is virtually impossible to establish. Moreover, in this study we did not assess the prevalence of sleep anxiety and bedtime resistance, which have previously been associated with excessive TV viewing. Finally, it is worth noting that of all the different types of media exposure, this study only took into account the amount of TV viewing. However, other media exposure, including time spent with video, computer games, pop music, and other media, is much higher (Christakis *et al.*, 2004a).

It should also be noted that direction of causality cannot be assessed in cross-sectional studies. We cannot rule out the possibility that some variables not measured in the present study might have been responsible for the association. However, the literature provides some solid evidence that TV viewing can cause various psychiatric symptoms (Strasburger and Donnerstein, 1999; Villani, 2001). For example, a recent longitudinal study suggested that extensive TV viewing is associated with increased likelihood of aggressiveness later (Johnson *et al.*, 2002). Moreover, a systematic reduction in the time of TV viewing leads to significant decrease in aggressive behavior (Robinson *et al.*, 2001), suggesting a direct causal link between TV exposure and behavior. It is therefore likely that TV viewing can impair children's sleep quality.

This study adds important depth and breadth to our current understanding of the origins of children's sleeping difficulties as well as of TV viewing and its consequences, because previous research into the harmful effects of TV viewing has mainly focused on school-aged children and only little work has been done on the effects of TV viewing on sleep. Most of the previous research has concentrated on active TV viewing which – especially in the case of young children – mainly consists of watching 'more benign' children's programs. Passive TV exposure has only rarely been considered (Anderson and Evans, 2001; Vandewater *et al.*, 2005). Earlier investigations have demonstrated that TV viewing is related to children's sleeping difficulties. Our findings additionally indicate that both passive exposure to TV and exposure to adult content are especially harmful to young children's sleep quality.

Our study suggests that health-care professionals should be aware of the association between TV viewing and sleep disturbances. Clinical practice should take note of the potential negative effects of high TV exposure, especially viewing adult programs and passive TV exposure on sleep in young children. It has been previously suggested that media history should be included into the standard evaluation of children and adolescents (Villani, 2001). Parents should be advised to control the quantity of TV viewing, to monitor the program content viewed, and to limit children's exposure to passive TV. Watching TV at bedtime should be discouraged. Reducing the quantity of passive TV exposure and limiting children's opportunities to watch adult-targeted programs might help to reduce children's sleeping problems and increase average sleep duration, which could further lead to beneficial changes in children's daytime behavior. TV viewing habits are learned at a very young age (Certain and Kahn, 2002), and children with heavy TV exposure at early ages tend to spend more and more time with TV as they grow older (Vandewater *et al.*, 2005). Therefore the earlier the interventions are started the better.

Future studies might benefit from looking beyond the amount of TV viewing and from pursuing a qualitative line of inquiry. Some types of TV programs are likely to be more harmful than others, while other TV programs may be beneficial in terms of development and learning. It would also be important to compare risks in different age groups and to try and uncover new factors that contribute to or modify the negative effects of TV exposure.

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