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# Associations Between Content Types of Early Media Exposure and Subsequent Attentional Problems

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## ABSTRACT

**OBJECTIVE.** Television and video/DVD viewing among very young children has become both pervasive and heavy. Previous studies have reported an association between early media exposure and problems with attention regulation but did not have data on the content type that children watched. We tested the hypothesis that early television viewing of 3 content types is associated with subsequent attentional problems. The 3 different content types are educational, nonviolent entertainment, and violent entertainment.

**METHODS.** Participants were children in a nationally representative sample collected in 1997 and reassessed in 2002. The analysis was a logistic regression of a high score on a validated parent-reported measure of attentional problems, regressed on early television exposure by content and several important sociodemographic control variables.

**RESULTS.** Viewing of educational television before age 3 was not associated with attentional problems 5 years later. However, viewing of either violent or non-violent entertainment television before age 3 was significantly associated with subsequent attentional problems, and the magnitude of the association was large. Viewing of any content type at ages 4 to 5 was not associated with subsequent problems.

**CONCLUSIONS.** The association between early television viewing and subsequent attentional problems is specific to noneducational viewing and to viewing before age 3.

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### Key Words

television, media, attention problems, ADHD, executive function

### Abbreviations

ADHD—attention-deficit/hyperactivity disorder  
PSID—Panel Survey of Income Dynamics  
CDS—Child Development Supplement  
BPI—Behavior Problems Index  
OR—odds ratio  
CI—confidence interval

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**P**OOOR ATTENTION REGULATION among grade-school children significantly impairs educational performance, imposes significant cost burdens on schools, and is a source of considerable anxiety for parents and teachers. When manifested as attention-deficit/hyperactivity disorder (ADHD), such problems are among the most common chronic diseases of childhood, affecting somewhere between 4% and 11% of children.<sup>1-3</sup> Although the genetic role in the cause of ADHD has been well established, comparatively little is known about the environmental risk factors,<sup>4-6</sup> yet given an increasing recognition of gene-environment interactions in the genesis of ADHD, more research into environmental factors is clearly warranted. As stated in the Surgeon General's report on mental health, "For most children with ADHD, the overall effects of these gene abnormalities seem small, suggesting that nongenetic factors also are important."<sup>7</sup> There has been speculation of a role for television in ADHD for decades,<sup>8-10</sup> and although much of this speculation has been unscientifically based, there is sound reason to suspect a possible role for early television, especially if it is particularly heavy and occurs early in life. The first 3 years of life are characterized by tremendous development, much of which occurs in response to the environment. The newborn brain is developing rapidly and characterized by great plasticity in response to the child's environment.<sup>11-13</sup>

The theoretical mechanisms through which early television viewing might impair healthy development of attention regulation may be moderated through the type of on-screen content. The theory of displacement suggests that television's deleterious effects operate by displacing developmentally appropriate learning opportunities with an attention-grabbing stimulus with little developmental value. In this theory, because educational shows such as *Sesame Street* and *Dora the Explorer* are designed to foster learning, they will be less harmful and may even be helpful compared with shows that are produced purely for entertainment. The theory of formal features suggests that the fast pacing and rapid scene changes that are characteristic of television reward fixed attention to a constantly changing stimulus and do not reward self-directed attention to opportunities for learning. Here again, educational shows would be expected to be less damaging because their pacing is typically much slower.<sup>14</sup>

An earlier study<sup>15</sup> found modest but significant associations between total television viewing before age 3 and problems with attention regulation at age 7, controlling for a variety of possible confounders, including the level of parental emotional support and cognitive stimulation provided to the child in the first years of life. Another study found no association between television viewing at age 5 and attention problems at age 6.<sup>16</sup> A third study of 170 children aged 2 to 5 found a positive and significant contemporaneous association between

television viewing and teacher report of ADHD symptoms based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, and also between television viewing and actigraph measurements of child movement.<sup>17</sup> No study to date has disaggregated viewing by content type. This work raises 2 important questions: (1) Is the association between early television viewing and subsequent attentional problems moderated by the type of content viewed? (2) Are the first 3 years of life a critical age range within which children are more vulnerable to the effects of media than is the case at later ages?

## METHODS

### Data Source

The Panel Survey of Income Dynamics (PSID) is a longitudinal study begun with 4800 families in 1968 with a variety of funding sources and overseen by the National Science Foundation. In 1997, the Child Development Supplement (CDS), which is a questionnaire administered to the primary caregivers of 3563 children aged 0 to 12, was added. The questionnaire, funded by the National Institute of Child Health and Human Development, included detailed demographic data, psychological and behavioral assessment of parents and children, and time use diary data from 1 randomly chosen weekday and 1 randomly chosen weekend day during a school year (September through May). These diaries include primary and secondary activities during a 24-hour period. Such time diaries have been used extensively in research and have excellent validity when compared with direct observation of activities.<sup>18,19</sup> Among eligible households in the core PSID sample, 1997 CDS data were obtained for 88%. In 2002, the respondents of the first CDS were followed up with a second, similar CDS (CDS-II). The follow-up rate from the 1997 CDS to the 2002 CDS was 91%.

These data are in the public domain. The research was approved by the Children's Hospital and Regional Medical Center Institutional Review Board.

### Children

We included all children who participated in the study, were younger than 5 years, and had follow-up data 5 years later. We divided the sample into children who were younger than 3 and those who were 4 to 5 years of age at baseline (so that at follow-up they were either 5-8 or 9-10 years of age).

### Outcome Measure

The PSID included the Behavior Problems Index (BPI), a brief, parent-response inventory of behavior problems that is derived from and similar to the Achenbach Child Behavior Checklist.<sup>20,21</sup> Our dependent variable used the "hyperactive" scale of the BPI, which has been validated

and extensively used in published research.<sup>22–26</sup> It consists of 5 items that each measure elements of attention-regulation: difficulty concentrating, impulsive, easily confused, has obsessions, and restless. Each item allows 3 responses: not true, sometimes true, and often true, coded 1, 2, and 3, respectively. A summary score ranging from 5 to 15 is constructed by summing the scores. This scale has a Cronbach's  $\alpha$  value of .68 and a 2-week test-retest reliability of .68.<sup>26</sup> We dichotomized this scale at  $\geq 11$ , or 2 SDs above the mean. We chose this cutoff in part because it yielded a prevalence for attentional problems that is similar to published reports of ADHD prevalence among similar-aged children in community samples.<sup>23</sup> We chose to dichotomize the 15-point total scale rather than to use linear regression, ordered logit, or count data methods because the statistical assumptions of those models are violated in these data and because their results are not as easily interpreted. The dichotomous outcome used represents a high level of symptoms of attentional problems. In addition to capturing behavioral manifestations (restlessness and impulsivity), it captures the cognitive deficits (obsessions, easily confused, and difficulty concentrating) that characterize problems of attention regulation.<sup>27</sup>

### Main Predictors

We used content data for programming that were derived from the time diaries. A coding system was developed previously<sup>28</sup> to classify television shows and movies on video (hereafter both referred to as "shows") by content in several dimensions. An educational attribute was assigned when the show had a clear intent to educate, with an explicit cognitive or prosocial component, as follows: Cognitive informative: teaches a lesson with content similar to that found in schools (math skills, reading skills, other school readiness skills). Social informative: teaches a lesson about appropriate behavior or interpersonal interactions (eg, sharing, friendships, drug education).

Violent content was ascribed when "violence was a central and integral part of the plot or of the main characters' occupations, if the lead characters' main purpose was to fight or flee from violence, or if there was more violence in the program than would be expected in the everyday life of a child."<sup>29</sup> Although the term "violent" is used here, it should be understood that the definition includes hostile language, threatening behavior, and cartoon violence as well as realistic violence. A minimum of 2 coders evaluated each show for violence and educational content, with a interrater  $\kappa$  score of 0.81.<sup>28,29</sup> Differences were resolved by discussion. For this study, we classified shows into 3 categories: educational, nonviolent entertainment (ie, not violent and not educational), and violent entertainment (ie, violent and not educational). No educational shows contained violence.

Some shows could not be coded for violence, either because the name was inadequately reported (eg, "cartoons," "channel 13") or because the researchers could not evaluate the violent content of an uncommon but named video or show. These shows, 20% of the total, were included in the "nonviolent" category. Because these shows were not separately flagged, it was not possible to conduct sensitivity analyses by placing these shows into different categories or into their own category. Examples of common shows in each category are presented in Table 1. These example shows were commonly viewed by children aged 0 to 3 and those aged 4 to 5, with little difference in popularity across ages.

### Potential Confounders

We adjusted for several child and parental attributes that may confound the relationship between early television viewing and attentional capacity by virtue of being plausibly associated with both. These include the child's age, race/ethnicity, and gender. Each of these is associated with television viewing<sup>30,31</sup> and may affect either the risk or expression of symptoms of attentional problems.<sup>17,32</sup> We also controlled for region and urbanicity of residence, because of the possibility of cultural differences in reporting of symptoms across these attributes. We also controlled for several indicators of socioeconomic adversity that may be associated with early television viewing and that are risk factors for attentional problems, including number of children, mother's and father's educational levels, the mother's score on a depression instrument, presence of father in the household, and parental conflict.<sup>33</sup> The father's education was available for all children, and the level of parental conflict was imputed with the sample mean when the father was not present. In addition, we controlled for attributes of the child and the family that might affect the amount and kinds of early-life stimuli that the child receives, which in turn could affect development of executive function, which is thought to underlie attentional capacity<sup>12,32,34–36</sup>; these include birth order and validated measures of emotional support and cognitive stimulation.<sup>37,38</sup> By controlling for these characteristics, we at least partially control for the possibility that children who grow up in a rich cognitive environment are less likely to be exposed to high amounts of early television.

TABLE 1 Popular Titles According to Content Type

Educational	Nonviolent Entertainment	Violent Content
<i>Barney</i>	<i>Flintstones</i> (cartoon)	<i>Space Jam</i>
<i>Sesame Street</i>	<i>Aristocats</i>	<i>Lion King</i>
<i>Winnie the Pooh</i>	<i>Rugrats</i>	<i>Power Rangers</i>
<i>Arthur</i> (cartoon)	<i>Babe</i>	<i>Scooby Doo</i>
<i>Blue's Clues</i>	<i>Bambi</i>	<i>Looney Tunes</i>
<i>Doug</i>	<i>Family Matters</i>	<i>America's Funniest Home Videos</i>

## Statistical Analysis

We performed separate analyses by 2 age categories: children who were younger than 36 months (hereafter 0 to 3 years of age) at baseline in 1997 and those who were  $\geq 48$  months and  $< 72$  months of age at baseline (hereafter 4 to 5 years of age). Given the known and obvious source of confounding as articulated already, bivariate analyses would be biased and were not conducted.

Logistic regression was used to test for the association of early television viewing by content with BPI score indicating attentional problems 5 years later, controlling for demographic attributes and parenting variables as discussed. Appropriate sampling weights were used to provide nationally representative samples. All analyses were conducted by using Stata 9.0 statistical software.<sup>39</sup>

## RESULTS

For children who were aged 0 to 35 months in 1997, 560 children's parents completed both the CDS-I and the CDS-II. For the children who were aged 4 to 5 years in 1997, the figure is 407. Parents of boys, parents of black children, single mothers, and mothers with lower levels of education were significantly less likely to complete the CDS-II than other parents. No category of television viewing was associated with failure to complete the CDS-II. There were no other statistically significant differences in any of the 1997 covariates between those whose parents did versus did not complete the CDS-II. Of the 560 younger children, complete data were available for 542. Of the 407 older children, 391 had complete data. The children with missing data for any covariate were dropped.

Table 2 presents descriptive statistics of television viewing and the outcomes. Table 3 presents the results of fully adjusted logistic regressions of attentional problems on television viewing by content type for the 2 age groups.

For children who were younger than 3 years, educational television was not significantly associated with subsequent attentional problems. By contrast, each hour per day of average viewing of violent entertainment television was associated with approximately double the odds for attentional problems 5 years later (odds ratio [OR]: 2.20; 95% confidence interval [CI]: 1.19–4.08). Nonviolent entertainment television viewing was also significantly associated with subsequent attentional

**TABLE 3 Fully Adjusted Logistic Regression of Attentional Problems in 2002 on Media Exposure in 1997**

Parameter	Aged 0–36 mo in 1997	Aged 48–71 mo in 1997
Educational television		
OR (95% CI)	0.64 (0.32–1.28)	1.67 (0.80–3.50)
P	.21	.17
Nonviolent entertainment television		
OR (95% CI)	1.73 (1.02–2.94) <sup>a</sup>	1.31 (0.53–3.22)
P	.04	.56
Violent entertainment television		
OR (95% CI)	2.20 (1.19–4.08) <sup>a</sup>	0.80 (0.46–1.38)
P	.01	.42
Pseudo-R <sup>2</sup>	0.32	0.22
Wald statistic (22 degrees of freedom)	101.56	58.35
N	542	391

Results were adjusted for child's age, race/ethnicity, gender, and birth order; number of children; mother's and father's educational levels and region and urbanicity of residence; presence of father; family conflict; and mother's level of depression. In addition, measures of emotional support and cognitive stimulation were controlled.

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

problems, although not as strongly (OR: 1.73; 95% CI: 1.02–2.94). Figure 1 presents these results graphically. For children aged 4 to 5 years, television viewing of any content type was not significantly associated with attentional problems 5 years later.

## DISCUSSION

This analysis provides a replication and enhancement of previous studies of the association between early television viewing and subsequent development of symptoms of attentional problems. The results here are consistent with a previous study that found a significant association between television viewing before age 3 and subsequent attentional problems<sup>15</sup> and also with a previous study that failed to find a significant association between television viewing at age 5 and subsequent attentional problems.<sup>16</sup> The replication of these 2 distinct results in 1 data set suggests that it is viewing specifically before age 3 that is relevant.

This analysis also enhances the insights from these previous studies by isolating the independent effects of 3 different types of media content: educational shows (eg, *Sesame Street*), nonviolent entertainment shows (eg, *The Aristocats*), and violent entertainment (eg, *Looney Tunes*). Viewing violent or nonviolent entertainment before age 3 is shown to be a significant and meaningful risk for the

**TABLE 2 Descriptive Statistics of Sample, 0- to 36-Month-Olds and 48- to 71-Month-Olds**

Parameter	Aged 0–36 mo		Aged 48–71 mo	
	Without Attention Problems	With Attention Problems	Without Attention Problems	With Attention Problems
Educational television, mean (SD)	0.37 (0.65)	0.40 (0.58)	0.30 (0.54)	0.37 (0.58)
Nonviolent entertainment television, mean (SD)	0.38 (0.66)	0.87 (1.27)	0.88 (0.98)	0.89 (0.82)
Violent entertainment television, mean (SD)	0.27 (0.63)	0.64 (1.14)	0.57 (0.88)	0.49 (0.61)
N	492	50	352	39

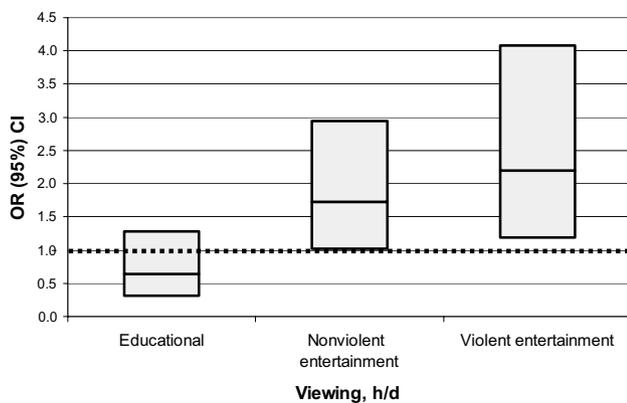


FIGURE 1  
ORs of having symptoms of attentional problems according to media content.

development of subsequent attentional problems, whereas viewing educational shows presents no such risk (Fig 1).

Previous studies have shown that educational programs have longer scene lengths than noneducational programming. This suggests that it might in fact be the pacing of programs that may overstimulate the developing brain. Still, other plausible hypotheses for why content may matter exist.

By displacing opportunities for pretend play, television may displace opportunities for specific cognitive development that is subsequently important for executive function. It is noteworthy that among older children, *Mister Rogers' Neighborhood* has been shown to enhance pretend play and imagination,<sup>40</sup> whereas noneducational and violent programming has been shown to inhibit them.<sup>41,42</sup>

Television generally and children's noneducational shows specifically use language that is essentially adult-like in its pacing and pronunciation. This language, therefore, is quite different from "motherese," the special form of language that mothers use instinctively with their young children.<sup>43-45</sup> As spoken in live social interactions, motherese changes with the abilities of the developing infant in a way that is attuned to his or her growing ability level.<sup>45-47</sup> Developmental neuroscientists have hypothesized that this special acoustic signal, especially as delivered in social settings, taps fundamental neurologic processes that are involved in promoting language in the developing brain of young infants.<sup>48</sup> The explicitly interactive component of motherese is helpful both to give the parent time to modulate his or her performance in accordance with the needs of the child and for teaching the natural give and take of language.<sup>49</sup> Noneducational television language duplicates few of the essential features of motherese. Educational shows such as *Mister Rogers' Neighborhood*, by contrast, mimic the noninteractive elements of motherese to the extent possible.<sup>50</sup> We hypothesize, therefore, that by displacing

frequent interactions with adult caregivers, a heavy diet of noneducational television will delay a child's language development.

Finally, self-regulation of affect may be impeded by noneducational television because of its frequently loud and aggressive content. Animated television shows are notoriously violent,<sup>51,52</sup> and an assessment<sup>53</sup> of animated feature films found that 100% of the G-rated animated films that were released in the United States from 1937 to 1999 contained at least some violence. Even the commercials during children's programs are violent and conflict ridden.<sup>54</sup> By contrast, prosocial content of the type found in *Mister Rogers' Neighborhood* can promote prosocial behavior, at least among older children.<sup>55,56</sup> We propose that the content typically found on television and in videos does not promote emotional self-regulation but rather inhibits it.

Although this theory emphasizes long-term developmental trajectories, the results presented here are also consistent with studies in the psychology literature that have evaluated the effects of television immediately after viewing. A 1973 study found that children who watched *Mister Rogers' Neighborhood* in a laboratory setting or played instead of watching any television had greater tolerance for delay immediately afterward than children who had watched *Batman*.<sup>55</sup> In another study, those who watched *Power Rangers* had shorter attentional capacity immediately afterward than those who had watched *Mister Rogers' Neighborhood* or played.<sup>57</sup> By contrast but consistent with the results here, another study found no difference in impulsivity after children watched 40 minutes of slow-paced or fast-paced versions of *Sesame Street*.<sup>58</sup>

In referring to educational programming, this discussion has mentioned *Mister Rogers' Neighborhood* and *Sesame Street* because they have been extensively researched. Other educational programs, including some excellent ones on other networks, presumably have similar beneficial or at least nonharmful effects.

There are several limitations worth discussing. First, the outcome measure is only an approximation of psychopathology. There may be biases in the parental reporting of problematic symptoms, and there is certainly considerable measurement error. Although the effects of any potential biases are unknowable, the effect of measurement error would be to reduce the likelihood of finding an effect, a conservative bias. The outcome measure here may not be specific to ADHD but may serve as a proxy for other problems of executive function. This limitation suggests that the analysis is unable to distinguish whether the association between early noneducational television viewing and subsequent attention problems is specific to symptoms of ADHD or whether, as seems more likely, it is general to deficits of executive function. In a subanalysis of these data that used a similarly dichotomized outcome on a 3-item scale com-

posed of “restless,” “impulsive,” and “difficulty concentrating,” the results were virtually identical to those reported here. So were the results of a subanalysis of a 2-item scale composed of “has obsessions” and “easily confused.” We do not attach much importance to these subanalyses because they involve the use of scales that have not been psychometrically vetted, but these results are consistent with a general association with symptoms that are broader than just those of ADHD. A recent study<sup>17</sup> found a contemporaneous association between television viewing and ADHD using more robust measures of the outcome. Future research should attempt to replicate the results here with a more precise and accurate measure of the developmental outcome, whether ADHD, attentional problems, or executive function. Second, although time diary data such as those used here have been found to have a high degree of validity,<sup>59</sup> the measure of early exposure to television is based on a small number of days, which may have led to measurement error in the exposure. Again, this problem should be rectified in future research with more accurate assessments of early viewing but represents a conservative effect in this analysis. Finally and most fundamental, the results here are observational rather than experimental; accordingly, the results suggest only an association, not a causal relationship. The longitudinal design goes some way toward reducing the likelihood that the results are attributable to reverse causality (viz, the possibility that children with attentional problems are more likely to watch television than children without such problems), particularly if one believes that attentional problems are not fully manifest before age 3. The variables that were included to control for parenting style (early cognitive support and early emotional stimulation) go some way toward reducing the likelihood that the results are attributable to residual confounding, but these solutions are not perfect, and there remains the possibility that the results here could be partially or entirely explained by either reverse causality or residual confounding. These limitations are balanced by several strengths, including the study’s longitudinal design, the control for several attributes that are likely to be highly correlated with parenting behavior, and data on television viewing by content type.

## CONCLUSIONS

Early television viewing is associated with the subsequent development of problems with attention regulation. This study shows that the association is specific to noneducational television, particularly violent fare, and that the association is specific to exposure before age 3. We believe that the associations between early television viewing and attentional problems are now sufficiently well established to warrant a randomized trial to assess causality in this association. There would be considerable benefit of such a study both if experimentally in-

duced television reduction were associated with differences in attention-regulation, in which case parents could be appropriately advised about the impact of early television viewing on subsequent attention problems, and if such a television reduction were not associated with such differences, in which case parents could be reassured about the lack of such an impact.

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## Associations Between Content Types of Early Media Exposure and Subsequent Attentional Problems

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