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# Does Childhood Television Viewing Lead to Attention Problems in Adolescence? Results From a Prospective Longitudinal Study

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## ABSTRACT

**CONTEXT.** There is controversy over whether childhood television viewing causes attention problems. The findings from cross-sectional and longitudinal studies have been mixed. To our knowledge, no longitudinal studies have assessed the impact of children's television viewing on attention problems in adolescence. The objective of this study was to assess this association.

**DESIGN, PARTICIPANTS, AND SETTING.** Study members were a general population birth cohort of 1037 participants (502 female) born in Dunedin, New Zealand, between April 1972 and March 1973. Parental estimates of children's television-viewing time were obtained at ages 5, 7, 9, and 11 years. Self-, parent-, and teacher-reported attention problems in adolescence were obtained at ages 13 and 15 years.

**RESULTS.** The mean of hours of television viewing during childhood was associated with symptoms of attention problems in adolescence. These associations remained significant after controlling for gender, attention problems in early childhood, cognitive ability at 5 years of age, and childhood socioeconomic status. This association was also independent of adolescent television viewing.

**CONCLUSIONS.** Childhood television viewing was associated with attention problems in adolescence, independent of early attention problems and other confounders. These results support the hypothesis that childhood television viewing may contribute to the development of attention problems and suggest that the effects may be long-lasting.

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### Key Words

child, adolescence, television, attention deficit, longitudinal studies

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**T**HERE IS WIDESPREAD concern about the increasing prevalence of attention problems in children.<sup>1-6</sup> Excessive television viewing has been cited as a possible cause of this problem.<sup>4,5,7-9</sup> It has been suggested that television is so exciting that real-life tasks, such as schoolwork, may seem boring by comparison, leading to difficulties in maintaining attention.<sup>10</sup> Others have even suggested that the rapid sequence changes during television programs may influence neurologic development.<sup>11</sup> However, the causal link between television viewing and attention problems has been disputed.<sup>12-14</sup>

To date, the empirical evidence linking television viewing to attention problems is scant. Although most,<sup>7,15-17</sup> but not all,<sup>18</sup> cross-sectional studies have identified an association between television and attention, only a few longitudinal studies have assessed the temporal relationship between television viewing and later attention problems. Christakis et al<sup>11</sup> found that television exposure in American preschool children was associated with attention problems by 7 years of age. A Danish cohort<sup>19</sup> found no such relationship, whereas another American study<sup>14</sup> found only a weak association between television viewing at age 5 and symptoms of attention-deficit/hyperactivity disorder at 6 years of age, and because the effect sizes were small, the authors concluded that this relationship was not meaningful.

Thus, the evidence for a causal association between television viewing and attention problems is limited. The temporal relationship between these 2 variables is unclear, and although cross-sectional studies suggest that the association between attention problems and television is stronger in older children,<sup>16,20</sup> no longitudinal studies have explored this relationship in later childhood or adolescence. Cross-sectional studies are also unable to assess whether the adverse effects of television viewing on attention persist or whether these are only short-term effects that dissipate if television viewing is reduced. In this article, we assess the long-term association between time spent watching television in childhood and attention problems in adolescence in a population-based birth cohort. We hypothesized that childhood television viewing would be associated with attention problems in adolescence.

## METHODS

### Participants

The Dunedin Multidisciplinary Health and Development Study was described in detail elsewhere.<sup>21</sup> Briefly, the study was an investigation of the health and behavior of children born in Dunedin, New Zealand, between April 1, 1972, and March 31, 1973. All children still residing in the Otago province at 3 years of age were invited to participate in the first follow-up assessment at 3 years of age. One thousand thirty-seven children (52% male; 91% of eligible births) participated in this first assess-

ment, forming the base sample for the longitudinal study. Study members were assessed every 2 years up to 15 years of age and again at age 18, 21, 26, and 32 years. Study members represent the full range of socioeconomic status in the general population of New Zealand's South Island and are primarily of New Zealand European ethnicity. This report uses data obtained at birth and ages 3 ( $n = 1037$ ), 5 ( $n = 991$ ), 7 ( $n = 954$ ), 9 ( $n = 955$ ), 11 ( $n = 925$ ), 13 ( $n = 850$ ), and 15 ( $n = 976$ ) years.

### Television Viewing

Childhood weekday television-viewing hours were obtained at ages 5, 7, 9, 11, 13, and 15 years. From ages 5 to 11 years, the study members' parents were asked how long their children spent watching television on weekdays.<sup>22</sup> Our primary measure of childhood television viewing was the mean of the times reported at these ages. At ages 13 and 15 years, the study members themselves were asked how long they usually spent watching television on weekdays, and the mean of these was used as a composite measure of adolescent television viewing.

### Attention Problems

Information on early childhood attention problems was obtained at ages 3 and 5 years. During the psychometric assessment at each age, psychologists rated each child's attention using 2 items: attention span, which was rated on a scale from 1 (very brief) to 4 (more than average) and goal orientation, which was rated from 1 (no effort) to 5 (compulsive absorption). At 5 years of age, the study members' parents were asked a single item ("How well is [name] able to concentrate on a task in his general play?"). This item was rated on a 4-point scale (0 = cannot sustain attention for >3 minutes, 1 = can sustain concentration for 3-10 minutes, 2 = usually sustains concentration for 10 to 30 minutes, and 3 = often sustains concentration for >30 minutes). The study members' teachers also completed a single item from the Rutter Behavior Questionnaire<sup>23</sup> (has poor concentration or short attention span) using a 3-point scale (0 = no, doesn't apply, 1 = yes, applies somewhat, and 2 = yes, certainly applies). All the scores, except the teacher report item, were reverse coded so that a higher score represents greater attention problems. All scores were then converted to standard ( $z$ ) scores, and the mean of these was used to create a composite measure of early attention problems. The internal reliability coefficient (Cronbach's  $\alpha$ ) for this early attention problems scale was  $\alpha = .70$ .

Adolescent attention problems were derived from self-, parent-, and teacher-reported measures obtained when the study members were 13 and 15 years old. At both ages, the study members' parents completed the Quay and Peterson Revised Problem Behavior Checklist,<sup>24</sup> which contained a 16-item attention problems

subscale (eg, short attention span, poor concentration; inattentive to what others say; and distractible, easily diverted from the task at hand). At 13 years of age, the study members' teachers were asked to complete the Rutter Child Scale (Scale B for teachers),<sup>23</sup> which contained a 9-item attention problems subscale (eg, become easily distracted, fail to finish things he/she starts, and have difficulty sticking to a play activity). All items were rated on the 3-point scale described earlier, and the responses for each scale were summed. Cronbach's alphas were 0.91 and 0.93 for the parent and teacher scales at 13 years of age and 0.90 for the parent scale at 15 years of age. Self-reported attention problems at ages 13 and 15 years were measured using the age-appropriate Diagnostic Interview Schedule for Children<sup>25</sup>. This is a structured interview that assessed symptomatology for *the Diagnostic and Statistical Manual of Mental Disorders, Third Edition*.<sup>26</sup> The attention problems scale included 8 items (eg, "When people are talking to you, do you have trouble paying attention to them?," "Do you find you often start your schoolwork and not finish it?," and "Do you have a hard time doing your schoolwork when there are noises or other things going on in the room?"), and items were rated by using the same 3-point scale. The scores for the items at each age were summed to create 2 attention problem scores. Cronbach's alphas for these scales were 0.62 at both ages. Finally, the 5 attention scales were converted to standard scores, and the mean of these was used as a composite measure of attention problems in adolescence. Cronbach's  $\alpha$  for these 5 scales was .75.

### Covariates

Socioeconomic status of the study members' families was measured by using parental self-reported occupational status assessed from birth to 15 years of age. Each parent was assigned an occupational code (ranging from 1 = professional to 6 = unskilled laborer) based on educational level and income for that occupation from data in the New Zealand census.<sup>27</sup> Final socioeconomic status scores were obtained by taking the highest score of either parent and calculating the mean of those scores from birth to age 15.<sup>28</sup> A measure of early cognitive ability was obtained at 5 years of age by using the third edition of the Stanford-Binet Intelligence Scale.<sup>29</sup>

### Statistical Analyses

We used multiple linear regression to test the association between childhood television viewing and attention problems in adolescence. Initially, these were adjusted for gender only. Additional analyses were also adjusted for early attention problems, early cognitive ability, and childhood socioeconomic status. Results are reported as standardized regression coefficients ( $\beta$ ) such that the coefficients represent the difference in attention problems, measured in standard deviations, for every 50

minutes of television viewing. We assessed whether the effects of childhood television on adolescent attention problems were long lasting, or whether they were mediated by adolescent television viewing. In an alternative analysis, we used logistic regression to assess the association between childhood television viewing and the risk of high attention problems (top 10%) in adolescence.<sup>11</sup> Gender interaction terms were computed, but they were not significant in any of the regression models and are not shown. Although the television variables were normally distributed, the attention data were positively skewed. However, the residuals of the 2 fully adjusted models were normally distributed, and the final analyses were performed by using untransformed data.

We obtained written informed consent for each assessment. The study was approved by the ethics committee of the Otago Hospital Board.

### RESULTS

The study members watched an average of 2.05 hours (SD: 0.83) of weekday television between the ages of 5 to 11 years. At ages 13 to 15 years of age, this increased by more than an hour per day to 3.13 hours per weekday (SD: 1.43). There was a significant correlation between childhood and adolescent television viewing ( $r = 0.39$ ;  $P < .0001$ ). Early attention problems and attention problems in adolescence were also correlated ( $r = 0.44$ ;  $P < .0001$ ). Results from linear regression models found that childhood television viewing predicted adolescent attention problems, adjusting for gender, with a standardized regression coefficient ( $\beta$ ) of .12 ( $P = .0001$ ). This association remained when further controlling for early attention problems, early cognitive ability, and childhood socioeconomic status ( $\beta = .09$ ;  $P = .0020$ ), representing a 0.09-SD increase in attention problems for every 50 minutes of television viewing. When adolescent television viewing was added to the model, both childhood and adolescent television viewing were independently associated with attention problems in adolescence ( $\beta = .06$ ,  $P = .0515$  and  $\beta = .16$ ,  $P < .0001$ , respectively).

Analyses using logistic regression models obtained similar results, with childhood television viewing predicting high adolescent attention problems (top 10%). For each hour of television viewing, the odds ratio for high attention problems in adolescence was 1.43 (95% confidence interval: 1.11–1.85) after adjusting for gender, and 1.44 (95% confidence interval: 1.08–1.91) after further adjusting for early attention problems, early cognitive ability, and socioeconomic status.

Standard scores of attention problems according to 4 categories of childhood television viewing are presented in Figure 1. Those who watched >2 hours, and particularly those who watched >3 hours, of television per day during childhood had above-average symptoms of attention problems in adolescence.

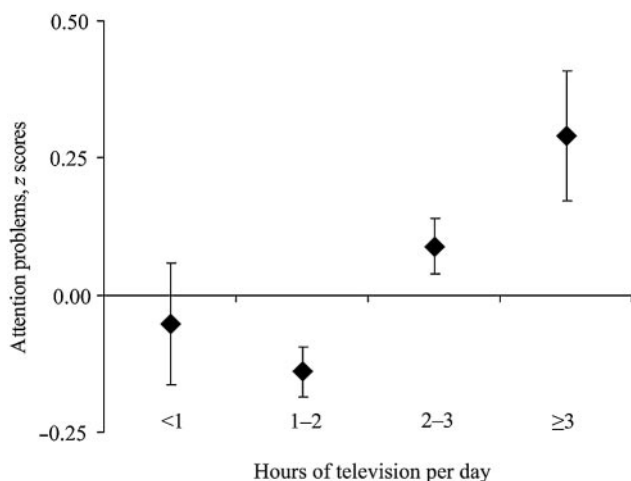


FIGURE 1

Standard scores of attention problems for mean hours of childhood television viewing between the ages of 5 and 11 (<1 hour of television,  $n = 94$  [10%]; 1–2 hours,  $n = 412$  [42%]; 2–3 hours,  $n = 369$  [38%];  $\geq 3$  hours,  $n = 105$  [11%]). Error bars represent 1 SE of the mean.

## DISCUSSION

In this general population longitudinal study, we found that a greater number of hours of childhood television viewing was associated with attention problems in adolescence. This association was independent of a number of potential confounders, including gender, early attention problems, cognitive ability, and childhood socioeconomic status. These findings lend support to the hypothesis that childhood television viewing may contribute to the development of attention problems.

We also assessed whether the effect of childhood television viewing was mediated by adolescent viewing. In this analysis, both childhood and adolescent television viewing were entered into the fully adjusted regression model simultaneously. We found that both childhood and adolescent television viewing independently predicted attention problems in adolescence. This suggests that the effects of childhood viewing on attention may be long lasting and largely independent of the continuity of television viewing into adolescence.

At least 2 explanations have been proposed for the association between television viewing and attention problems. One explanation targets brain development in early childhood. Because there is considerable brain plasticity during the first few years after birth, the rapid image and scene changes commonly found in television may overstimulate the child and adversely affect brain development.<sup>11</sup> If this is true, we might expect very young children to be particularly vulnerable to these effects, whereas older children would be less affected. Another explanation is that life as portrayed on television with its fast-paced editing and attention-grabbing techniques makes reality seem boring by comparison. Hence, children who watch a lot of television may become less tolerant of slower-paced and more mundane

tasks, such as school work.<sup>10</sup> We would expect this mechanism to be less age-dependent. Our finding that television viewing in middle childhood was associated with adolescent attention problems tends to support the latter hypothesis. However, the 2 explanations are not mutually exclusive, and both may play a role in the association between television viewing and attention problems.

There may be other mechanisms, and it is possible that multiple pathways explain the association between television viewing and attention problems. For example, it may be that television viewing displaces other activities that promote and encourage attention, such as reading, games, sports, and play. Also, inattention may be a conditioned response. That is, television programs will continue, regardless of the attentional input from the viewer. Therefore, children may learn that they can divert their attention when watching television. This learned response might generalize to other activities.

Christakis et al<sup>11</sup> found an association between very early television viewing (ages 1 and 3 years) and attention problems in children at 7 years of age. Our results show that there is a similar association between television viewing in later childhood and attention problems in adolescence. These findings suggest that the adverse effects of television may be cumulative. Obel et al<sup>19</sup> did not find an association between early childhood television viewing (age 3 1/2 years) and attention problems with hyperactivity at 10 to 11 years of age. However, the authors observed that the children in their sample watched far less television than the children in the study by Christakis et al<sup>11</sup> and, therefore, had reduced power to detect such an effect. Stevens and Mulsow<sup>14</sup> only found a weak and clinically unimportant relationship between television viewing at 5 years of age and symptoms of attention problems with hyperactivity at 6 years of age.

The studies by Obel et al<sup>19</sup> and Stevens and Mulsow<sup>14</sup> considered the effects of television viewing on attention problems with hyperactivity. It is possible that including hyperactivity in the outcome measures obscures the effects observed by Christakis and colleagues and ourselves. In our study, there was no association between childhood television and hyperactivity in adolescence, after controlling for early symptoms of hyperactivity (data not shown). It seems likely that the impact of television viewing on attention problems is different from that on symptoms of hyperactivity. Therefore, we suggest that future research into the effects of television should distinguish between attention and hyperactivity.

Our study has a number of strengths. Data were collected prospectively throughout childhood and adolescence in a large general-population sample with a high rate of participation. We were, therefore, able to control for effects of a number of important confounders that may signal a predisposition to attention problems, including early attention problems and cognitive ability.

We assessed hours of television viewing at multiple ages, and our final measure represents a pattern of viewing behavior throughout childhood. We also obtained reports of adolescent attention problems from 3 sources, providing us with a comprehensive outcome measure.

As with any observational research, we were unable to prove that childhood television causes attention problems in adolescence. Although the association was independent of a number of potential confounding factors, including gender, early attention problems, early cognitive ability, and socioeconomic status, it remains plausible that children with attention problems simply chose to watch more television or that the causal pathways are bidirectional. We have no data on television viewing before the age of 5 years and are unable to assess whether preschool viewing has a long-lasting impact on attention. Because we used a global measure of childhood television-viewing time, we are also unable to determine whether entertainment and educational television have different effects. However, our results show that the net effect of television seems to be adverse. Children's television programs in New Zealand are mostly American or British in origin, with few locally made programs.<sup>30</sup> Therefore, the television content seen by our study members was probably similar to that watched by children in other English-speaking countries.

Future research needs to assess these limitations and address the possible mechanisms by which television causes attention problems. Attention problems are known to be an important predictor of poor educational achievement<sup>31-34</sup> and have also been implicated in poor socialization.<sup>35</sup> It, therefore, seems prudent to observe the recommendation of the American Academy of Pediatrics<sup>36</sup> to limit children's television viewing to a maximum of 2 hours per day.

## CONCLUSIONS

We found a prospective association between childhood television viewing and attention problems in adolescence. Our results show that this is independent of gender differences, early inattention problems, socioeconomic status, and cognitive ability. The results support the hypothesis that excessive television viewing may lead to attention problems in children and adolescents.

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#### EFFICACY STILL UNCERTAIN FOR WIDELY USED SUPPLEMENTS FOR ARTHRITIS

“While researchers continue to search for drugs targeting the cartilage loss that occurs with osteoarthritis, many patients with this condition and other causes of joint pain are emptying drug store shelves of the over-the-counter dietary supplements glucosamine and chondroitin sulfate. An estimated 1 million people take these products regularly, spending between \$800 per person per year, said Marc Hochberg, MD, MPH, of the University of Maryland School of Medicine, in Baltimore. Although glucosamine and chondroitin sulfate are often touted in the lay press as remedies for osteoarthritis, which affects at least 20 million US adults, their effectiveness in easing joint pain and preventing disease progression is unproven. Anecdotal reports from patients and results from studies in animals, particularly horses (Goodrich LR, Nixon AJ. *Vet J*. 2006;171:51–69), indicate that the supplements’ effects are not likely solely attributable to a placebo effect. . . . Felson and his colleagues will soon publish a meta-analysis of clinical trials of glucosamine and chondroitin sulfate that he said revealed marked differences in trial results that are not due to chance. . . . Most trials without industry funding or participation reported null findings, but several trials sponsored by industry reported effects that were equivalent or better than the effect of a total knee replacement, ‘a result that I regard as hard to believe,’ said Felson.”

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