

ORIGINAL ARTICLE

Children with a TV in their bedroom at higher risk for being overweight

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Objective: We examined having a TV in the bedroom as a risk factor for child overweight.

Design: Cross-sectional study.

Setting: School- and telephone-based surveys in New Hampshire and Vermont between 2002 and 2004.

Participants: Two thousand three hundred and forty-three children enrolled in public schools, aged 9–12 years, and one of their parents.

Main exposures: The child having a TV in the bedroom.

Main outcome measures: Age- and gender-standardized child body mass index (zBMI). Overweight was defined as equal to or above the 95th percentile for zBMI.

Results: Overall, 22.3% ($N = 523$) of the children were overweight, and almost half of all children (48.2%, $N = 1130$) had a TV in their bedroom. Children with a TV in their bedroom had a higher zBMI and were significantly more likely to be overweight compared to those without a TV in their bedroom (27.3 versus 17.7%, respectively; $P < 0.05$). After controlling for sociodemographics, physical activity, frequency of TV or movie watching and internet use, children with a TV in their bedroom who watched at least one session of TV or movies per day were more likely to be overweight compared to those without a TV in their bedroom (odds ratio = 1.32, 95% confidence interval: 1.03, 1.70).

Conclusions: Having a TV in the bedroom is a risk factor for child overweight, independent of reported physical activity, participation in team sports, TV or movie watching time and internet use at home. Further study is needed to fully understand the mechanism by which having a TV in the bedroom increases children's risk for overweight.

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Keywords: television; children; overweight; bedroom

Introduction

As the prevalence of child overweight trends upward,¹ child media use is also dramatically increasing.² Studies linking the convergence of these two trends have demonstrated that high levels of TV use are significantly associated with child overweight.^{3–6} The average American household with children aged 8–18 years has three TV sets, and 68% of children have a TV in their own bedroom.² Averaging at least 3 h a

day, child media exposure to TV exceeds other media, including exposure to videos/DVDs/movies, print media, audio media, computers and video games.² High amounts of TV use have been associated with many negative outcomes, including poor scholastic performance,^{7,8} sleep deprivation,^{9,10} child requests for advertised foods,¹¹ eating fewer fruits and vegetables and more pizza/snack food/soda,¹² greater consumption of high-fat foods¹³ and higher BMI.^{4–6,14} Overweight is associated with many diseases,^{1,15–17} and the greater the degree of overweight as a child, the greater the likelihood that child will be overweight as an adult.^{18,19}

Extensive research addressing the intersection of TV use and child overweight has included known risk factors for child overweight, such as sociodemographics (e.g., gender, ethnicity, household income, parent education),^{20,21} dietary intake (amounts and types of foods eaten),¹³ presence of TV at meals,¹² perception of parental weight status^{5,20} and

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measures of physical activity.^{4,22} However, studies of TV use and child overweight have largely overlooked the presence of a TV in a child's bedroom. Conversely, many studies of media and the home environment have assessed the presence of a TV in a child's bedroom,^{7,9,23-26} but only two studies also assessed the risk of child overweight.^{21,27} Saelens *et al.*²⁷ found that, in younger children, time spent watching TV was associated with having a TV in the bedroom and with weight status, but did not examine the association between having a TV in the bedroom and weight status. Dennison *et al.*²¹ found that having a TV in the child's bedroom was a risk factor for child overweight in preschool-aged children from low-income families, but did not include a measure of physical activity.

The present study examines the presence of a TV in the child's bedroom and its relation to child overweight in children aged 9-12 years. We hypothesized that having a TV in the child's bedroom is a risk factor for child overweight, over and above other variables known to predict child obesity, including sociodemographics and television watch-

ing time. We included measures of physical activity, and other media usage, including frequency of watching movies and using the internet.

Methods

The data analyzed for the current study are from a longitudinal survey designed to investigate the association between parenting factors, movie viewing and smoking uptake in children. The study was approved by the Committee for the Protection of Human Subjects at Dartmouth College.

Subjects

We identified and enrolled 2343 child/parent pairs through school surveys administered in New Hampshire (NH) and Vermont (VT) public schools between October 2002 and December 2003. The sample recruitment design is outlined

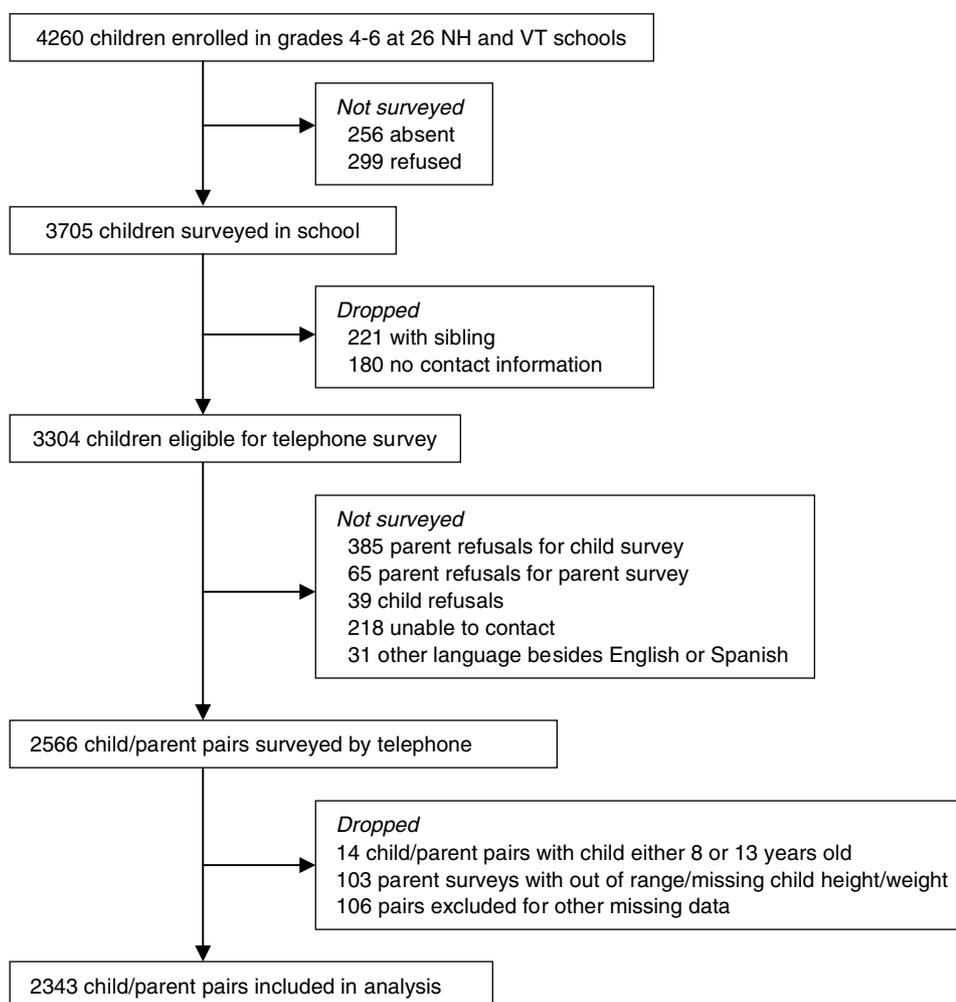


Figure 1 Cohort enrollment.

in Figure 1. We randomly selected schools from a list of all NH and VT schools containing grades 4 through 6 ($N=559$ schools), stratified by state and number of students enrolled. Twenty-six schools from 25 different communities participated. Each school was offered a \$500–\$750 stipend. One quarter ($N=6$) of the communities had less than 2500 residents and 72% ($N=18$) had less than 10 000 residents.

All surveys were conducted by trained survey administrators. The baseline survey consisted of two components, a self-administered in-school survey followed by a telephone interview an average of 9 weeks later. In all but one school, passive consent was used, whereby parents received an advance letter informing them of the survey and instructing them to call the school if they did not want their child to participate. At one school, active consent was used whereby parents mailed in a signed consent form. The in-school and telephone surveys were administered in English and Spanish.

For the in-school survey, children completed a self-administered, written questionnaire in the classroom. Teachers were present but did not assist with survey administration. Children wrote their names and telephone numbers on a form collected separately from the survey and linked by an algorithm. For the telephone survey, our interviewer team contacted households where the child had provided a complete working telephone number. If two or more siblings had completed the school survey, we randomly selected one child from each household to ensure unique child/parent pairs. Whenever possible, we surveyed the child's mother. Based on the children's young age and their limited ability to estimate time, we relied on parents to report child physical activity, frequency of family television viewing and child height and weight. The child school questionnaire plus the subsequent telephone interviews of child/parent pairs represent the complete baseline survey for this cohort.

Interviewers administered the telephone survey using an individualized computer-assisted telephone interview system with special features to facilitate implementation and ensure participant confidentiality. Verbal parental consent and verbal child assent were obtained before surveying children and parents by phone. Refusal rates were low, with only 12.8% (385 parents, 39 children) refusing to complete the telephone survey. We successfully completed telephone interviews with 2566 child/parent pairs (including 2395 mothers, 115 fathers and 56 other guardians), representing 77.7% of eligible children. Eleven 8-year olds and three 13-year olds with complete data were dropped from the analysis owing to low sample sizes in those age groups. For this analysis, we had complete data for 2343 child/parent pairs (Figure 1). We excluded 209 pairs because of missing data or out-of-range age- and gender-standardized child body mass index (zBMI) as defined below.

Measures

Overweight. From parental reports of their child's height and weight, we calculated zBMI,²⁸ using the EpiInfo analysis

package developed by the Epidemiology Program Office of the Centers for Disease Control and Prevention (CDC). The BMI values were standardized to the 2000 CDC reference. 'Overweight' status is defined as zBMI equal to or greater than the 95th percentile. 'At risk for overweight' is defined as zBMI equal to or greater than the 85th percentile. Reported weight of less than 42 lbs, height of less than 39 inches, or height and weight combinations resulting in BMI values less than 13 – all of which are much less than the 5th percentile for 9-year-olds – were treated as out-of-range values.

Media variables. We assessed five media variables:

TV access in the bedroom. We ascertained the presence of a TV in their bedroom by asking children, 'Do you have a TV in your bedroom that you can watch television or movies on?' (Yes/No).

Child overall TV access. We asked parents the question, 'How many televisions do you have in your home?'

TV or movie watching frequency. We asked children, 'Do you usually watch TV or movies before school/after school/after supper?' Responses to these three questions were combined to indicate the number of watching sessions per day (range: 0–3).

Family TV or movie watching frequency. We asked parents, 'On average, how many nights per week does your family watch television or movies together?' Response options to this question were none, one to three, four to six and every night; the first two categories were combined to include 0–3 nights.

Internet usage frequency. We asked parents, 'Do you have internet access at home' (Yes/No), and 'How often does <CHILD NAME> use the internet at home?' Response options to the latter question were never, less than once a month, a few times per month, a few times a week, every day and do not know; the categories were combined using data from both questions into no internet at home, never/less than once per month, a few times per month, a few times a week or more.

Physical activity. Physical activity was assessed with two variables. We asked parents, 'Aside from physical education or gym at school, how often does <CHILD NAME> engage in physical activity?' Response options included less than once a week, 1–3 times a week, 4–6 times a week and every day; the first two responses were combined into less than 3 days per week. We asked children, 'In the past year, did you participate in team sports?' (Yes/No).

Sociodemographics. Children reported their age, gender and race. Parents reported their highest level of education completed and their annual household income.

Statistical analysis

Categorical data were analyzed initially using χ^2 tests. Generalized estimating equations were used to model the probability of being overweight with adjustment for clustering at the school level. Minimally adjusted models included terms for school and sociodemographics. We additionally assessed confounding by controlling for physical activity, team sport participation and other media usage. The fully adjusted model accounted for the previous variables plus frequency of TV or movie watching sessions. Our models separately assess the influence of having a TV in the bedroom among children who report no TV viewing and among those who report at least some TV viewing. Initial exploratory models included number of TV sessions as a categorical variable. We also tested for interactions of having a TV in the child's bedroom with TV sessions, gender, parent education and parent income. Odds ratios (ORs) with 95% confidence intervals (CIs) are reported. A *P*-value of less than 0.05 (two-sided) was considered statistically significant, without adjustment for multiple comparisons. Data were analyzed using SAS version 9.1.²⁹ Graphs were created using S-plus version 6.1.³⁰

Results

Table 1 presents characteristics of the 2343 child/parent pairs. Data obtained through child surveys are denoted with a 'C', and through parent surveys are denoted with a 'P'. Child respondents ranged in age from 9 to 12 years. Half of the children in the sample were female (*N* = 1169, 49.9%). The majority of the children were white (*N* = 1774, 75.7%), reflecting the demographics of the underlying population. About a third of the parents reported having a high school diploma or less (*N* = 750, 32.0%), and about the same proportion (*N* = 825, 35.2%) reported having an annual household income of \$40 000 or less.

Almost half of all children (48.2%, *N* = 1130) had a TV in their bedroom. Predictors of having a TV in the bedroom included the child being older, male, non-white, having parents with a high school diploma or less and a household income of less than \$40K. Compared to children without a TV in their bedroom, children with a TV in their bedroom were more likely to have three or more TVs in their household, more likely to have the highest number of TV or movie watching sessions per day, more likely to not have the internet at home, more likely to watch TV or movies together with their families every night, and were less likely to be physically active and to participate in team sports (Table 1).

Almost a quarter of the sample (22.3%, *N* = 523) was overweight, and 20.4% (*N* = 478) were at risk for overweight. Children with a TV in their bedroom were more likely to be overweight compared to those without a TV (27.3 versus 17.7%, respectively; *P* < 0.05) (Table 1). Sociodemographic predictors of child overweight included being male, non-

Table 1 Descriptive statistics

Predictor	N	% with TV in bedroom	% overweight
<i>Sociodemographics</i>			
<i>C: Child age (years)</i>			
9	455	45.9*	24.8
10	874	46.0	23.5
11	755	49.8	19.9
12	259	55.2	21.2
<i>C: Child gender</i>			
Male	1174	50.3*	24.7*
Female	1169	46.2	19.9
<i>C: Child race</i>			
White	1774	45.8**	21.2*
Non-white	569	55.9	25.8
<i>P: Parent education</i>			
High school diploma or less	750	66.5**	30.0**
Some college or Associate's degree	920	50.0	22.5
Bachelor's or graduate degree	673	25.4	13.5
<i>P: Household income</i>			
\$40 000 or less	825	60.0**	30.8**
\$40 001–\$65 000	703	48.4	20.6
More than \$65 000	815	36.2	15.2
<i>Media usage</i>			
<i>C: TV in bedroom</i>			
No	1213		17.7*
Yes	1130		27.3
<i>P: Number of TVs in household</i>			
0	5	0.0**	20.0
1	271	12.9	16.6
2	652	30.2	22.9
3 or more	1415	63.5	23.2
<i>C: Watch TV or movies before school / after school / after supper</i>			
0 sessions	128	19.5**	11.7**
1 session	378	30.2	19.0
2 sessions	1057	48.4	21.9
3 sessions	780	61.4	26.2
<i>P: Child internet use at home</i>			
No internet at home	388	59.5**	28.6*
Never/less than once per month	446	46.9	20.9
A few times per month	656	42.2	20.3
A few times a week or more	853	48.4	21.8
<i>P: Nights per week family watches television or movies together</i>			
None to three	1365	42.9**	20.7*
Four to six	499	50.5	22.4
Every night	479	61.2	26.9
<i>Physical activity</i>			
<i>P: Child physical activity</i>			
Less than 3 days per week	764	52.4*	29.1**
4–6 days per week	860	45.5	18.8
Every day	719	47.1	19.3
<i>C: Participate in team sports</i>			
No	657	54.3**	28.0**
Yes	1686	45.8	20.1

* χ^2 *P*-value < = 0.05. ** χ^2 *P*-value < = 0.001.

white, having parents with a high school diploma or less and a household income of less than \$40K. Media and physical activity predictors of child overweight included the child watching the highest number of TV or movie watching sessions per day, not having the internet at home, watching TV or movies together with their families every night, being the least physically active and not participating in team sports.

The average zBMI for all children was 0.72. Boys had a higher average zBMI than girls, even though we used an age- and gender-adjusted BMI calculation (0.82 versus 0.65, $P=0.0002$). Among children who reported zero TV or movie watching sessions, there was no significant difference in average zBMI (Figure 2). Among children who self-reported watching at least one TV or movie watching session every day, there was a positive association between frequency of TV or movie watching sessions and zBMI. The zBMI increased approximately 0.1 U for each additional viewing session reported ($P=0.005$) (Figure 2).

In the model adjusted for school and sociodemographics, children with a TV in the bedroom were more likely to be overweight compared to those without a TV in the bedroom (OR = 1.36, 95% CI: 1.05, 1.76) (Table 2). Adding physical activity to this model did not notably change the OR of child overweight. Among children who watched at least one session of TV or movies every day, having a TV in the bedroom increased the child's likelihood of being overweight (OR = 1.32, 95% CI: 1.03, 1.70), even after controlling for physical activity and other media usage (see fully adjusted model; Table 2). Additional sessions of TV or movie watching did not significantly increase the risk of being overweight (OR = 1.04, $P=0.55$) (Table 2). For children who reported no TV or movie watching sessions, there was no additional risk of being overweight due to having a TV in the bedroom (OR = 1.80, 95% CI: 0.41, 7.97). In addition, there were no statistically significant interactions of having a TV in the bedroom with gender, parent education or parent income.

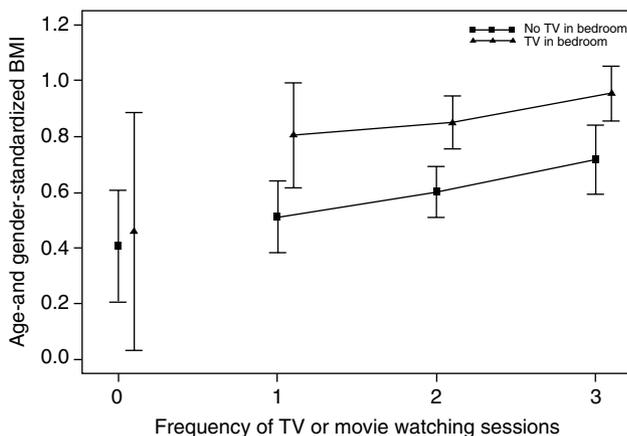


Figure 2 Percent of overweight children by frequency of TV or movie watching sessions and presence of TV in the bedroom.

Discussion

Our study demonstrates that having a TV in the bedroom is a significant predictor of child overweight. We found that even after controlling for the expected risk factors for overweight such as frequency of TV watching sessions, physical activity and socioeconomic status, children with a TV in the bedroom were still 1.3 times more likely to be overweight than children without a TV in their bedroom. It is important to note that a TV in the bedroom was associated with a higher risk of overweight only among children who reported at least one session of TV daily. It was not associated, however, with overweight among children who did not watch TV. Although we do not yet know the mechanism by which having a TV in the bedroom increases the risk for child overweight, this suggests that having a TV in the bedroom is not simply a proxy for other individual or family characteristics. Rather, watching TV in the bedroom is likely an indicator of several processes, such as increased sedentary activity or snacking, that increase one's risk for overweight. The way in which having a TV in the bedroom influences these processes remains to be elucidated.

Even at this young age, almost half of children in our sample had a TV in their bedroom. This is less than the current national average of 68%,² but consistent with previous research that reported the prevalence of having a TV in the bedroom for a similar age group.^{25–27} Also consistent with other research, we found that children from lower income households were more likely to have a TV in their bedroom.^{2,25} Plausible explanations for this association may include that lower income households have less available space in their homes, or that TV offers an affordable form of entertainment. Surprisingly, children with a TV in their bedroom were also more likely to watch TV or movies together with their families, possibly indicating that they come from high-media use households. Although we did see a positive trend of frequency of TV or movie watching with zBMI, the relationship was not statistically significant. We would expect that measuring time intervals of TV or movie watching may show a sharper upward trend.

Children with a TV in their bedroom were less likely to be engaged in physical activity and team sports, although we were unable to explore the temporal relationship between these factors. We do not know if the child had a TV in the bedroom because he or she did not have other activities to keep him or her busy, or if having the TV in the bedroom decreased the likelihood that he or she would engage in physical activity. We did find that children who engaged in physical activity 4 or more days per week and those who participated in team sports were significantly less likely to be overweight.

Although we have controlled for many sociodemographic variables, this study was not originally designed to examine the effect of TV in the bedroom on overweight. As such, our study did not assess parental adiposity, child food intake or

Table 2 ORs (95% CI) for child zBMI ≥ 95th percentile

Predictor	Adjusted for school and sociodemographics	Adjusted for school, sociodemographics and physical activity	Fully adjusted ^a	P-value
<i>C: TV in bedroom</i>				
No	Reference	Reference	Reference	0.044
Yes	1.36 (1.05, 1.76)	1.34 (1.03, 1.74)	1.32 (1.03, 1.70)	
<i>Sociodemographics</i>				
<i>C: Child age (years)</i>				
9	Reference	Reference	Reference	0.073
10	0.93 (0.72, 1.20)	0.91 (0.71, 1.17)	0.92 (0.71, 1.19)	
11	0.71 (0.52, 0.97)	0.71 (0.52, 0.97)	0.70 (0.51, 0.96)	
12	0.77 (0.56, 1.07)	0.75 (0.55, 1.03)	0.74 (0.54, 1.02)	
<i>C: Child gender</i>				
Male	Reference	Reference	Reference	0.007
Female	0.74 (0.58, 0.95)	0.67 (0.53, 0.86)	0.67 (0.52, 0.85)	
<i>C: Child race</i>				
White	Reference	Reference	Reference	0.40
Non-white	1.07 (0.83, 1.39)	1.10 (0.86, 1.40)	1.12 (0.88, 1.43)	
<i>P: Parent education</i>				
High school diploma or less	Reference	Reference	Reference	0.022
Some college or Associate's degree	0.80 (0.61, 1.07)	0.82 (0.61, 1.10)	0.82 (0.61, 1.11)	
Bachelor's or graduate degree	0.53 (0.40, 0.70)	0.55 (0.42, 0.73)	0.57 (0.44, 0.74)	
<i>P: Household income</i>				
\$40 000 or less	Reference	Reference	Reference	0.012
\$40 001–\$65 000	0.66 (0.50, 0.88)	0.68 (0.51, 0.90)	0.68 (0.50, 0.91)	
More than \$65 000	0.54 (0.41, 0.71)	0.58 (0.44, 0.76)	0.58 (0.43, 0.79)	
<i>Physical activity</i>				
<i>P: Child physical activity</i>				
Less than 3 days per week		Reference	Reference	<0.001
4–6 days per week		0.64 (0.50, 0.83)	0.64 (0.50, 0.83)	
Every day		0.58 (0.47, 0.72)	0.59 (0.48, 0.73)	
<i>C: Participate in team sports</i>				
No		Reference	Reference	0.024
Yes		0.77 (0.63, 0.95)	0.78 (0.63, 0.95)	
<i>Other media usage</i>				
<i>C: Frequency of TV watching sessions^b</i>			1.04 (0.91, 1.19)	0.55
<i>P: Child internet use at home</i>				
No internet at home			Reference	0.54
Never/less than once per month			0.84 (0.62, 1.13)	
A few times per month			0.91 (0.67, 1.23)	
A few times a week or more			1.00 (0.73, 1.37)	

Abbreviations: CI, confidence interval; OR, odds ratio; zBMI, age- and gender-standardized child body mass index. ^aAdjusted for school, sociodemographics, physical activity and other media usage. ^bNumber of sessions treated as a continuous variable among children who reported watching any TV or movies. For children who did not usually watch TV or movies, there was no additional risk of being overweight due to having a TV in the bedroom (OR = 1.80, 95% CI: 0.41, 7.97).

parent and child eating behaviors. Further work is needed to clarify how dietary intake and family characteristics may contribute to the association between having a TV in the bedroom and childhood overweight. However, we did measure internet use, which typically has not been assessed in studies of media and child obesity. Although our measures of physical activity did not capture the specific physical activities that children participate in, they were strong enough to show a significant relationship with overweight. Although we did not actually measure child BMI, parental

report of adolescent weight status has been found to be accurate, with greater tendency to underestimate rather than overestimate.^{31,32} If parents in this study did underestimate their child's weight, it would only bias our results towards the null hypothesis. Our measure of TV viewing frequency, which was fairly crude, could also contribute to underestimating the observed effect. Strengths of our study include a large rural sample size, diverse socioeconomic status and measurement of several media exposure measures, including watching movies and using the internet.

Obesity is determined by many different factors, including genetic, metabolic, behavioral, psychosocial and environmental influences,^{33–38} presenting multiple opportunities for intervention. However, despite creative efforts and the investment of substantial resources, there has been very limited success preventing obesity through interventions targeting individual behaviors.^{39,40} In this study, frequency of child internet use was not significantly associated with overweight status. This finding supports the notion that the association between TV viewing and child overweight is not simply due to the amount of time children spend in front of a screen. Investigators have suggested that the positive association between TV viewing and child overweight may be owing to decreased physical activity, increases in caloric intake or a reduction in resting metabolic rate.^{5,41} Research has also shown differential eating patterns between those who eat in front of the TV and those who do not.¹² Other potential mediating variables could include increased exposure to food-related advertising directed at children,^{42,43} or interference with sleep. Two studies have demonstrated that children who receive less than 10 h of sleep per night were more likely to be obese,^{44,45} and additional research has shown that having a TV in the bedroom is associated with fewer hours of sleep.⁹

To reduce child overweight status, successful interventions have included limiting the amount of time spent in front of the television.^{46–50} However, it is difficult to consistently monitor and limit TV viewing time over the long term. A simple and effective screen for child risk factors for overweight that could be employed by pediatricians and other health-care providers would be to ask if a child has a TV in his or her bedroom. Parents of overweight children could then be encouraged to remove the TV from their child's bedroom. Whereas some researchers have questioned the clinical relevance of limiting amount of TV viewing to prevent child overweight,⁵¹ there are additional reasons why parents are encouraged to limit their children's TV time and to remove the TV from their bedrooms. As discussed earlier, high levels of child TV viewing are associated with many negative outcomes, including decreased school performance and poor diet quality, and the American Academy of Pediatrics Committee on Public Education recommends that pediatricians should encourage parents to remove television sets from their children's bedrooms.⁵²

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References

- 1 US Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and*

- Obesity*. Public Health Service, Office of the Surgeon General: Rockville, MD, 2001.
- 2 Roberts D, Foehr UG, Rideout V. *Generation M: Media in the Lives of 8–18 Year-olds*. Kaiser Family Foundation: Menlo Park, March 2005.
- 3 Dietz Jr WH, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics* 1985; **75**: 807.
- 4 Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the Third National Health and Nutrition Examination Survey. *JAMA* 1998; **279**: 938–942.
- 5 Hernandez B, Gortmaker SL, Colditz GA, Peterson KE, Laird NM, Parra-Cabrera S. Association of obesity with physical activity, television programs and other forms of video viewing among children in Mexico City. *Int J Obes Relat Metab Disord* 1999; **23**: 845.
- 6 Salmon J, Bauman A, Crawford D, Timperio A, Owen N. The association between television viewing and overweight among Australian adults participating in varying levels of leisure-time physical activity. *Int J Obes Relat Metab Disord* 2000; **24**: 600.
- 7 Borzekowski DL, Robinson TN. The remote, the mouse, and the No. 2 pencil: the household media environment and academic achievement among third grade students. *Arch Pediatr Adolesc Med* 2005; **159**: 607–613.
- 8 Hancox RJ, Milne BJ, Poulton R. Association of television viewing during childhood with poor educational achievement. *Arch Pediatr Adolesc Med* 2005; **159**: 614–618.
- 9 Owens J, Maxim R, McGuinn M, Nobile C, Msall M, Alario A. Television-viewing habits and sleep disturbance in school children. *Pediatrics* 1999; **104**: e27.
- 10 Medrich EA. Constant television: a background to daily life. *J Commun* 1979; **29**: 171–176.
- 11 Taras HL, Sallis JF, Patterson TL, Nader PR, Nelson JA. Television's influence on children's diet and physical activity. *J Dev Behav Pediatr* 1989; **10**: 176–180.
- 12 Coon KA, Goldberg J, Rogers BL, Tucker KL. Relationships between use of television during meals and children's food consumption patterns. *Pediatrics* 2001; **107**: E7.
- 13 Matheson DM, Killen JD, Wang Y, Varady A, Robinson TN. Children's food consumption during television viewing. *Am J Clin Nutr Jun* 2004; **79**: 1088–1094.
- 14 Jeffery RW, French SA. Epidemic obesity in the United States: are fast foods and television viewing contributing? *Am J Public Health* 1998; **88**: 277.
- 15 Dietz Jr WH. Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics* 1998; **101** (Suppl): 518–525.
- 16 Johnston FE. Health implications of childhood obesity. *Ann Intern Med* 1985; **103**: 1068–1072.
- 17 Dietz WH, Robinson TN. Clinical practice. Overweight children and adolescents. *N Engl J Med* 2005; **352**: 2100–2109.
- 18 Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do obese children become obese adults? A review of the literature. *Prev Med* 1993; **22**: 167–177.
- 19 Guo SS, Roche AF, Chumlea WC, Gardner JD, Siervogel RM. The predictive value of childhood body mass index values for overweight at age 35 y. *Am J Clin Nutr* 1994; **59**: 810–819.
- 20 Robinson TN, Hammer LD, Killen JD, Kraemer HC, Wilson DM, Hayward C et al. Does television viewing increase obesity and reduce physical activity? Cross-sectional and longitudinal analyses among adolescent girls. *Pediatrics* 1993; **91**: 273–280.
- 21 Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. *Pediatrics* 2002; **109**: 1028–1035.
- 22 Armstrong CA, Sallis JF, Alcaraz JE, Kolody B, McKenzie TL, Hovell MF. Children's television viewing, body fat, and physical fitness. *Am J Health Promot* 1998; **12**: 363–368.

- 23 Bernard-Bonnin AC, Gilbert S, Rousseau E, Masson P, Maheux B. Television and the 3- to 10-year-old child. *Pediatrics* 1991; **88**: 48–54.
- 24 Stanger JD. *Television in the Home 1998. The Third Annual National Survey of Parents and Children*. Annenberg Public Policy Center, University of Pennsylvania: Philadelphia, PA, 1998.
- 25 Woodard EH, Gridina N. *Media in the Home 2000. The Fifth Annual Survey of Parents and Children*. Annenberg Public Policy Center of the University of Pennsylvania: Philadelphia, PA, 2000.
- 26 Wiecha JL, Sobol AM, Peterson KE, Gortmaker SL. Household television access: associations with screen time, reading, and homework among youth. *Ambulatory Pediatr* 2001; **1**: 244–251.
- 27 Saelens BE, Sallis JF, Nader PR, Broyles SL, Berry CC, Taras HL. Home environmental influences on children's television watching from early to middle childhood. *J Dev Behav Pediatr* 2002; **23**: 127–132.
- 28 Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, Flegal KM, Guo SS, Wei R et al. CDC growth charts: United States. *Adv Data Jun* 8; **2000**: 1–27.
- 29 SAS [computer program] Version 9.1. SAS Institute, Inc.: Cary, NC, 2002.
- 30 S-PLUS. [computer program] Version 6.1. Insightful Corporation: Seattle, WA, 2002.
- 31 Goodman E, Hinden BR, Khandelwal S. Accuracy of teen and parental reports of obesity and body mass index. *Pediatrics* 2000; **106**: 52–58.
- 32 Boutelle K, Fulkerson JA, Neumark-Sztainer D, Story M. Mothers' perceptions of their adolescents' weight status: are they accurate? *Obes Res. Nov* 2004; **12**: 1754–1757.
- 33 Strauss RS, Knight J. Influence of the home environment on the development of obesity in children. *Pediatrics* 1999; **103**: 1278.
- 34 Dietz WH. Overweight in childhood and adolescence. *N Engl J Med* 2004; **350**: 855–857.
- 35 Stice E, Presnell K, Shaw H, Rohde P. Psychological and behavioral risk factors for obesity onset in adolescent girls: a prospective study. *J Consult Clin Psychol* 2005; **73**: 195–202.
- 36 Hill JO, Melanson EL. Overview of the determinants of overweight and obesity: current evidence and research issues. *Med Sci Sports Exerc* 1999; **31** (Suppl): S515–S521.
- 37 Ellis L, Haman D. Population increases in obesity appear to be partly due to genetics. *J Biosoc Sci* 2004; **36**: 547–559.
- 38 Lefebvre PJ, Scheen AJ. Obesity: causes and new treatments. *Exp Clin Endocrinol Diabetes* 2001; **109** (Suppl 2): S215–S224.
- 39 Lowe MR. Self-regulation of energy intake in the prevention and treatment of obesity: is it feasible? *Obes Res* 2003; **11** (Suppl): 44S–59S.
- 40 Muller MJ, Asbeck I, Mast M, Langnase K, Grund A. Prevention of obesity – more than an intention. Concept and first results of the Kiel Obesity Prevention Study (KOPS). *Int J Obes Relat Metab Disord* 2001; **25** (Suppl 1): S66–S74.
- 41 Klesges RC, Shelton ML, Klesges LM. Effects of television on metabolic rate: potential implications for childhood obesity. *Pediatrics* 1993; **91**: 281–286.
- 42 Halford JC, Gillespie J, Brown V, Pontin EE, Dovey TM. Effect of television advertisements for foods on food consumption in children. *Appetite* 2004; **42**: 221–225.
- 43 Lobstein T, Dobb S. Evidence of a possible link between obesogenic food advertising and child overweight. *Obes Rev* 2005; **6**: 203–208.
- 44 Locard E, Mamelie N, Billette A, Miginiac M, Munoz F, Rey S. Risk factors of obesity in a five year old population. Parental versus environmental factors. *Int J Obes Relat Metab Disord* 1992; **16**: 721–729.
- 45 Sekine M, Yamagami T, Handa K, Saito T, Nanri S, Kawaminami K et al. A dose–response relationship between short sleeping hours and childhood obesity: results of the Toyama Birth Cohort Study. *Child Care Health Dev* 2002; **28**: 163–170.
- 46 Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA* 1999; **282**: 1561–1567.
- 47 Epstein LH, Paluch RA, Gordy CC, Dorn J. Decreasing sedentary behaviors in treating pediatric obesity. *Arch Pediatr Adolesc Med* 2000; **154**: 220–226.
- 48 Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK et al. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. *Arch Pediatr Adolesc Med* 1999; **153**: 409–418.
- 49 Epstein LH, Valoski AM, Vara LS, McCurley J, Wisnicwski L, Kalarchian MA et al. Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. *Health Psychol* 1995; **14**: 109–115.
- 50 Jason LA, Brackshaw E. Access to TV contingent on physical activity: effects on reducing TV-viewing and body-weight. *J Behav Ther Exp Psychiatry* 1999; **30**: 145–151.
- 51 Marshall SJ, Biddle SJ, Gorely T, Cameron N, Murdey I. Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. *Int J Obes Relat Metab Disord* 2004; **28**: 1238–1246.
- 52 American Academy of Pediatrics. Children, adolescents, and television. *Pediatrics* 2001; **107**: 423–426.

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