

Television Viewing and Television in Bedroom Associated With Overweight Risk Among Low-Income Preschool Children

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ABSTRACT. *Context.* Television (TV) viewing is associated with obesity among school-aged children, adolescents, and adults, but this relationship has not been evaluated in preschool-aged children.

Objective. To describe the TV/video viewing habits of a multiethnic, low-income preschool population of children and to determine whether TV/video viewing is related to their adiposity.

Design. Cross-sectional survey of parents/guardians with measurements of children's height and weight.

Setting and Participants. Two thousand seven hundred sixty-one adults with children, 1 through <5 years, from 49 New York State agencies of the Supplemental Nutrition Program for Women, Infants, and Children.

Outcome Measures. Cross-sectional relationships between the amount of time the child spends viewing TV/video and the presence of a TV set in the child's bedroom, with the prevalence of overweight children (body mass index [BMI] >85th percentile) after adjustment for potential confounders.

Results. Mean TV/video viewing times were higher among black children and Hispanic children than white children and increased with the child's age. In multiple logistic regression, the odds ratio of children having a BMI >85th percentile was 1.06 (95% confidence interval [CI]: 1.004–1.11) for each additional hour per day of TV/video viewed, independent of child age, child sex, parental educational attainment, and race/ethnicity. Almost 40% of children had a TV set in their bedroom; they were more likely to be overweight and spent more time (4.6 hours per week) watching TV/video than children without a TV in their bedroom. In multiple logistic regression, the odds ratio of having a BMI >85th percentile was 1.31 (95% CI: 1.01–1.69) among those with a TV in their bedroom versus those without a TV, after statistical adjustment for child age, child sex, child TV/video viewing hours per week, maternal BMI, maternal education, and race/ethnicity.

Conclusions. This study extends the association between TV viewing and risk of being overweight to younger, preschool-aged children. A TV in the child's bedroom is an even stronger marker of increased risk of

being overweight. Because most children watch TV by age 2, educational efforts about limiting child TV/video viewing and keeping the TV out of the child's bedroom need to begin before then. *Pediatrics* 2002;109:1028–1035; *obesity, television, preschool, child, parent, behavioral.*

ABBREVIATIONS. BMI, body mass index; TV, television; WIC, Supplemental Nutrition Program for Women, Infants, and Children; NYS, New York State; CDC, Centers for Disease Control and Prevention; OR, odds ratio; CI, confidence interval.

Over the past 20 to 30 years, the prevalence of obesity has dramatically increased among adults and children in the United States.^{1–3} Fifty-five percent of adults are overweight with a body mass index (BMI) >25 kg/m²,¹ while 25% of 6- to 17-year-old children have a BMI >85th percentile,² and 22% of low-income children under 5 years of age have a weight for height >85th percentile.³ Longitudinal studies indicate that the overweight child is at significant risk of remaining overweight into adulthood.^{4,5} Although genetic factors predispose an individual to develop obesity and its comorbidities, the increasing prevalence of obesity among children and adults is more likely attributable to changes in environmental and lifestyle behaviors.

Among school-aged children, cross-sectional studies reveal a dose-response relationship between the amount of time viewing television (TV),^{6–10} time viewing TV/video,¹¹ or frequency of viewing TV¹² and the prevalence of obesity. Several recent studies in children and adults report that the relationship between TV viewing and obesity is independent of physical activity or fitness level.^{13–15} Among teenagers, the amount of time spent watching TV 4 to 6 years previously predicted incidence or remission rates of obesity.⁶

Elementary school-based interventions to reduce TV/video viewing have been associated with reductions in adiposity. In one study, reductions in TV viewing were associated with lower obesity rates among girls but not among boys.¹⁶ A more recent study found that reducing TV/video viewing and decreasing the number of meals eaten in front of the TV yielded significant reductions in BMI and in skin-fold thicknesses among both girls and boys.¹⁷ In a clinic-based obesity treatment program for children aged 8 through 12 years, reduction in sedentary activities (including watching TV and videos and playing computer and board games) was just as effective

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in reducing obesity measures as a program that increased physical activity levels.¹⁸

Although there has been recent concern about the effects of TV and video viewing by preschool-aged children, we found only 1 study evaluating TV viewing and adiposity among preschool children. DuRant and colleagues¹⁹ estimated the amount of time the children spent watching TV by directly observing 3- and 4- year-old children in their homes for up to 4 days (mean = 2.4 days). Children who watched more hours per day of TV and those who watched TV for longer periods of time were less likely to engage in physical activity. Unlike most previous studies in which parents estimated their child's usual TV viewing, DuRant et al did not find a relationship between the amount of observed TV viewing and the child's adiposity. Whether children's observed TV viewing represents their "usual" TV viewing habits or are similar to their TV viewing habits when not being observed is not known. Parental report of their child's "usual" TV viewing have been shown to correlate with both videotaped observations of the child's TV viewing²⁰ and with parental diaries of their child's TV/video viewing.^{20,21}

Children from families with lower educational attainment spend more time viewing TV than children from more highly educated families.²²⁻²⁴ Minority children watch more hours per week of TV than white children.^{7,11,25} The prevalence of overweight children is also higher among non-Caucasians.^{2,3} Therefore, it is possible that TV viewing and child obesity might be confounded by race/ethnicity and/or parental educational attainment. Recent studies have also raised concerns about the increasing presence of TV sets in children's bedrooms.^{17,26,27} Thus, the purpose of this study was to determine whether the amount of time preschool-aged children view TV/video is related to their overweight status, independent of race/ethnicity and parental educational attainment, and to determine whether a TV set in the child's bedroom is related to the child's weight status.

METHODS

Adults with children aged ≥ 1 through < 5 years, participating in the Supplemental Nutrition Program for Women, Infants, and Children (WIC) at 1 of the 49 WIC agencies in New York State (NYS) were eligible to be surveyed. The 49 WIC agencies were selected because they had been surveyed in 1998, as part of a racially and geographically balanced sample of NYS WIC agencies ($N = 15$), or because agency staff were participating in a counseling skills training program ($N = 41$, 7 of which were also 1 of the 15 agencies). In 1999 and again in 2000, clients attending 1 of the 49 WIC agencies were surveyed.

At each agency, the WIC Participant Survey in English or Spanish was self-administered, although clients could ask for assistance in completing the survey. One child per family was included, so that each parent/guardian was surveyed only once during each year. The 1999 sample and the 2000 sample were independent, thus a participant could, by chance, have been surveyed in both years. In 1999, surveys were collected between July 12 and December 9. In 2000, surveys were collected between May 27 and December 15. Although the study design was to survey 30 consecutive eligible adults at each WIC agency, logistic constraints at the WIC centers, at times, necessitated some variations in this protocol. The exact details of these deviations were not documented by staff at the WIC centers, nor was information collected

regarding participant refusal rates or whether assistance was given in computing the survey.

Data collected from the WIC Participant Survey is determined by WIC staff and reflects the interests of the WIC program and/or the NYS Department of Health. In 1999 and 2000, the surveys assessed child dietary behaviors, such as fruit and vegetable intakes and consumption of low-fat milk, child TV/video viewing habits, and demographic data. Each parent/guardian self-reported his/her race/ethnicity (Hispanic, non-Hispanic black, non-Hispanic white, Asian, Native American, multicultural, or other) and the last grade of school he/she completed (10th, 11th, high school degree, general equivalency diploma, < 2 years of college, 2 years of college, > 2 years of college but < 4 years of college, 4-year college graduate, Master's degree, or Doctoral degree). The parent/guardian also reported (in hours per day, with fractions entered as such) the amount of TV/videotapes that his/her child "usually watched" on weekdays, on Saturday, and on Sunday. For the year 2000 survey, each parent/guardian also reported his/her own weight and height, and whether or not the child has a TV set in his/her bedroom. All questions were pilot-tested but not validated.

The child's most recent height or length, weight, and date of measurement were abstracted from the WIC chart. At the time of this study, parents and children participating in NYS WIC visited the clinic every 2 months for nutrition counseling and to receive food vouchers. Children are required to have their height and weight measured every 6 months as part of the recertification process to ensure eligibility for program participation. Each child's height and weight was measured by trained WIC staff using standard protocols.²⁸ The child's height and weight was frequently measured on the same day the survey was completed (43%). If not, the child's most recent height, weight, and measurement date (within 4 months of the survey date) was abstracted from the WIC chart. Weight was measured using a standard balance beam scale. Height was measured for children > 36 inches tall or > 2 years of age using a wall-mounted stadiometer. Otherwise, child length was measured using a recumbent board; child length was converted to child height by subtracting 0.5 cm. For both child and parent, BMI was computed as weight in kilograms divided by the square of the height in meters (kg/m^2).

The institutional review boards of both the Mary Imogene Bassett Hospital and the NYS Department of Health approved the study. As NYS WIC staff have a program mandate to collect information annually from participants in the WIC program, consent of individuals completing these surveys was not deemed necessary and was not obtained. Before data entry and analysis, all identifying information was removed from the surveys by WIC staff.

Statistical Analysis

Data were analyzed using the Statistical Analysis Software (SAS, Version 8.0; Cary, NC). All statistical tests were 2-sided; P values $> .05$ were considered nonsignificant. Children were classified into 2 groups: those with a BMI for age ≤ 85 th sex-specific percentile and those with a BMI for age > 85 th sex-specific percentile using the BMI cutpoints of Frisancho.²⁹ The child's age on the date of measurement was used to determine the sex-specific BMI for age percentile. Thus, the group of children with a BMI > 85 th percentile includes both children "at risk for overweight" ($85\text{th} < \text{BMI} \leq 95\text{th}$ percentile) and "overweight" children ($\text{BMI} > 95\text{th}$ percentile).³⁰

For children 2 years of age and older, we compared the classification into BMI categories (BMI for age ≤ 85 th and BMI for age > 85 th sex-specific percentile) using the cutpoints of Frisancho²⁹ and the Centers for Disease Control and Prevention (CDC)³¹ using Kappa statistics. The Frisancho growth charts and the revised CDC growth charts are based on data from the first and second National Health and Nutrition Examination Surveys; NHANES I (1971-1974) and NHANES II (1976-1980). The revised CDC growth charts for children < 6 years, however, also include data from NHANES III (1988-1994).³¹ For mothers who completed a survey in 2000 and self-reported their height and weight, BMI was computed. Mothers with $\text{BMI} < 25 \text{ kg}/\text{m}^2$ were classified as not overweight and overweight categories of $25 \leq \text{BMI} < 30 \text{ kg}/\text{m}^2$, $30 \leq \text{BMI} < 35 \text{ kg}/\text{m}^2$, and $\text{BMI} \geq 35 \text{ kg}/\text{m}^2$ were created.¹

Parental educational attainment was categorized as ≤ 11 th grade, high school degree or general equivalency diploma, and

college (any attendance). Race/ethnicity was collapsed into Hispanic, non-Hispanic black, non-Hispanic white, and Other (Asian, Native American, multicultural). For some analyses, child age group strata were also created as 1 through <2 years, 2 through <3 years, 3 through <4 years, and 4 through <5 years of age.

Each child's total weekly hours spent viewing TV/video was estimated by multiplying by 5 the amount of time the child was reported to "usually" watch TV/video on weekdays, and adding the time he/she "usually" watched TV/video on Saturday and on Sunday. Because this TV/video viewing variable was found to have strong right skew, subsequent parametric analyses, such as analysis of variance (analysis of variance), were performed using both the natural log of the variable (after adding 0.1 hours per week to each value to eliminate zeros) and the untransformed variable. As there were no significant differences, the results presented are for the untransformed weekly TV/video viewing time variable. Based on the total weekly hours, the children were dichotomized into a group that "usually" watches TV/video (weekly TV/video time not equal to zero) or into a group that does not "usually" watch TV/video (weekly TV/video time equal to zero).

Differences in the continuous TV/video viewing time variable between the sexes, study years (1990 vs 2000), and BMI groups were examined by *t* tests. Differences in TV/video viewing time by race/ethnicity and by parental educational attainment were analyzed by analysis of variance. Scheffé posthoc test was used to further explain the nature of any significant overall *F* tests. Differences in the percentages of children viewing any TV/videos and the percentages of children viewing >2 hours per day (>14 hours per week) were compared by race/ethnicity with χ^2 tests, and by age group with Mantel-Haenszel χ^2 tests.

The relationships of dichotomous variables (such as child sex or child BMI group) with ordered variables (such as child age group or parental educational attainment) or other nonordered categorical variables were explored with Mantel-Haenszel χ^2 tests, or χ^2 tests, respectively. Demographic and other variables found to be related to child BMI group at the univariate level were then entered into a multiple logistic regression equation to identify independent predictors of children with a BMI >85th percentile.

Among year 2000 WIC Survey participants, the percentage of children reported to have a TV set in their bedroom was compared by race/ethnicity and by BMI group, using χ^2 tests. The mean TV/video viewing times of children with and without a TV set in his/her bedroom were compared using *t* tests. Demographic variables, including maternal BMI (based on self-reported height and weight), and other variables found to be related to child BMI at the

univariate level were entered into a multiple logistic regression equation to identify independent predictors of children with a BMI >85th percentile.

RESULTS

Surveys were completed by 2761 adults (1364 in 1999 and 1397 in 2000); 90% of them were the children's mother (Table 1). The age distribution of children in the study sample mirrors that seen among those enrolled in the WIC program, with a preponderance of children in the younger age strata ($\chi^2 = 59$; $P < .0001$). By self-report, the race/ethnicity of the study population included more whites (34.7% vs 26.8%) but fewer Hispanics (33.4% vs 34.5%) and fewer blacks (22.7% vs 29.2%) than the total WIC population at the 49 surveyed WIC agencies ($\chi^2 = 42$ [$df = 3$]; $P < .0001$).

The self-reported parental educational attainment differed by race/ethnicity (Mantel-Haenszel $\chi^2 = 100$ [$df = 1$]; $P < .0001$). For children 2 years of age and older, BMI classification (<85th versus >85th age- and sex-specific percentile) based on Frisancho²⁹ and the CDC³¹ were very similar (kappa = 0.94). Based on the Frisancho cutpoints, 37.1% (742/1999) of children had a BMI >85th percentile, whereas the CDC cutpoints classified 37.2% (744/1999) as being over this threshold. Because the classification schemes are so similar and the CDC tables do not list BMI percentiles for 1-year-old children, the Frisancho cutpoints were used in all subsequent analyses.

The prevalence of children with a BMI >85th percentile did not vary with child sex or child age. However, this phenomenon was related to race/ethnicity. Specifically, Hispanic children were found to have the highest prevalence (42.8%), compared with whites (32.7%), blacks (34.6%), or other race children (29.9%) ($\chi^2 = 27$ [$df = 3$]; $P < .0001$). The prevalence

TABLE 1. Distribution of Child Age, Sex, BMI, Parental/Guardian Educational Attainment, and Relationship to Child by Race/Ethnicity (N, %)

	Hispanic (N = 911)	Black (N = 621)	White (N = 949)	Other (N = 251)	Total (N = 2761)
Child					
Age (y)*	N = 910	N = 620	N = 947	N = 250	N = 2756
1	274 (30.1)	179 (28.9)	261 (27.6)	76 (30.4)	798 (29.0)
2	247 (27.1)	164 (26.5)	250 (26.4)	68 (27.2)	737 (26.7)
3	217 (23.9)	156 (25.2)	256 (27.0)	59 (23.6)	694 (25.2)
4	172 (18.9)	121 (19.5)	180 (19.0)	47 (18.8)	527 (19.1)
Sex (male)	482 (52.9)	294 (47.3)	484 (51.0)	131 (52.2)	1405 (50.9)
BMI†	N = 911	N = 621	N = 949	N = 251	N = 2761
>85th percentile	390 (42.8)	215 (34.6)	310 (32.7)	75 (29.9)	955 (36.0)
>95th percentile	223 (24.5)	124 (20.0)	172 (18.1)	36 (14.3)	555 (20.3)
Parent/guardian					
Relationship to child	N = 869	N = 616	N = 946	N = 242	N = 2698
Mother	809 (93.1)	549 (89.1)	866 (91.5)	212 (87.6)	2454 (91.0)
Father	25 (2.9)	24 (3.9)	31 (3.3)	24 (9.9)	108 (4.0)
Other	35 (4.0)	43 (7.0)	49 (5.2)	6 (2.5)	136 (5.0)
Educational attainment‡	N = 882	N = 614	N = 941	N = 243	N = 2702
≤11th grade	388 (44.0)	150 (24.4)	200 (21.3)	50 (20.6)	790 (29.2)
High school degree	311 (35.3)	264 (43.0)	449 (47.7)	96 (39.5)	1130 (41.8)
Some college	151 (17.1)	165 (26.9)	254 (27.0)	72 (29.6)	649 (24.0)
4-year college degree	32 (3.6)	35 (5.7)	38 (4.0)	25 (10.3)	133 (4.9)

* Child distribution varies by age (ie, includes more younger children than older children), for each race/ethnic group and for the total group; $\chi^2 = 58.7$; $P < .0001$.

† The prevalence of children with a BMI for age >85th sex-specific percentile differs by race/ethnicity, $\chi^2 = 27.4$ ($df = 3$); $P < .0001$.

‡ Parental educational attainment differs by race/ethnicity; Mantel-Haenszel $\chi^2 = 100$ ($df = 1$); $P < .0001$.

of children with a BMI >95th percentile did not differ by race/ethnicity.

The percentage of children with a BMI >85th percentile decreased with higher parental educational attainment (38% if ≤11th grade education, 37% if high school degree, 34% if education beyond high school, and 27% if college degree, (Mantel Haenszel = 5.6 [*df* = 1]; *P* < .02). After statistical adjustment for race/ethnicity, however, these educational differences did not persist.

The percentage of children watching TV/video increased with increasing child age (Table 2). Eighty-two percent of 1-year-old children watched TV/video, whereas 95%, 96%, and 98% of 2-, 3-, and 4-year-old children, respectively, watched TV/video (Mantel Haenszel $\chi^2 = 124$ [*df* = 1]; *P* < .0001). Among 1-year-old children, the percentage who did not watch TV/video was higher among whites (29%) than Hispanics (11%), blacks (15%) or others (20%), ($\chi^2 = 31$ [*df* = 2]; *P* < .0001). The percentage of children who watched TV/video did not differ by parental educational attainment.

Although mean weekly TV/video viewing hours did not differ between survey years (15.0 vs 14.5 hours per week; *t* = 1.3 [*df* = 2645]; *P* = .2), more children were found to be watching at least some TV/video (90% in 1999 vs 94% in 2000, $\chi^2 = 17$; *P* < .0001). Most of this increase was among the 1-year-old children, where the percentage increased from 78% in 1999 to 85% in 2000 ($\chi^2 = 5.7$ [*df* = 1]; *P* < .02). When stratified by race/ethnicity, only white 1-year-old children were found to have a significant increase in the proportion of children watching TV/video (66% in 1999 to 78% in 2000; $\chi^2 = 4.5$; *P* < .04; Fig 1).

Children's weekly mean TV/video viewing hours differed by race/ethnicity (Table 2). Hispanic children watched (mean ± SEM) 15.0 ± 0.6 hours per week, black children watched 17.5 ± 0.8 hours per

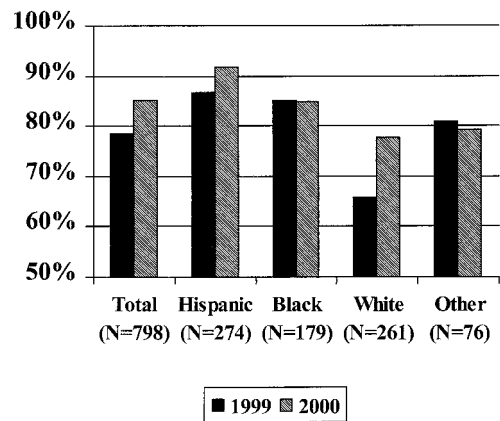


Fig 1. The percentage of 1-year-old children watching any TV/videos increased from 78% in the year 1999 sample to 85% in the year 2000 sample ($\chi^2 = 5.7$; *P* < .02). Most of this difference was attributable to an increase in the percentage of 1-year-old white children watching any TV/videos from 66% in 1999 to 78% in 2000 ($\chi^2 = 4.5$; *P* < .04).

week, white children watched 12.7 ± 0.5 hour per week, and other race children watched 14.9 ± 1.2 hours per week (*F* = 22 [*df* = 3; 2731]; *P* < .0001 by analysis of variance). Posthoc analysis using Scheffé test showed that this significant overall *F* was attributable to differences between blacks and each of the other three racial/ethnic groups (all *P* < .05).

Older children spent more time watching TV/videos than younger children (Table 2). The 1-, 2-, 3-, and 4-year-old children watched, on average (mean ± SEM), 10.9 ± 0.6, 14.9 ± 0.6, 16.3 ± 0.7, and 18.4 ± 0.8 hours per week of TV/video, respectively (*F* = 93 [*df* = 3; 2752]; *P* < .0001 by analysis of variance). Posthoc analyses showed that all age groups, except the 2-year-old children versus the 3-year-old children, watched significantly different amounts of TV (all *P* < .05). Consistent with the

TABLE 2. Children's Usual TV/Video Viewing Habits By Race/Ethnicity and Age

Children Viewing	Hispanic	Black	White	Other	Total
Any TV/video (N [%])*					
1-y-old	245/274 (89.4)	152/179 (84.9)	186/261 (71.3)	61/76 (80.3)	644/790 (81.5)
2-y-old	241/247 (97.6)	157/164 (95.7)	227/250 (90.8)	66/68 (97.1)	691/729 (94.8)
3-y-old	217/217 (100)	153/156 (98.0)	236/256 (92.2)	57/59 (96.6)	663/688 (96.4)
4-y-old	171/172 (99.4)	119/121 (98.4)	173/180 (96.1)	45/47 (95.7)	508/520 (97.7)
Mean h/wk (SEM)†					
1-y-old	11.6 (0.6)	13.8 (1.0)	8.6 (0.5)	9.1 (1.2)	10.9 (0.4)
2-y-old	14.7 (0.6)	17.6 (0.8)	13.2 (0.6)	16.4 (1.4)	14.9 (0.4)
3-y-old	18.1 (0.8)	17.5 (0.9)	14.0 (0.6)	17.0 (1.3)	16.3 (0.4)
4-y-old	17.0 (0.7)	23.0 (1.3)	16.4 (0.8)	19.6 (2.3)	18.4 (0.5)
>2 h/d‡ (N [%])					
1-y-old	78/274 (28.5)	68/179 (38.0)	45/261 (17.2)	11/76 (14.5)	202/790 (25.6)
2-y-old	101/247 (40.9)	92/164 (56.1)	87/250 (34.8)	36/68 (52.9)	316/729 (43.4)
3-y-old	120/217 (55.3)	83/156 (53.2)	91/256 (35.6)	34/59 (57.6)	328/688 (47.7)
4-y-old	97/172 (56.4)	87/121 (71.9)	87/180 (48.3)	26/47 (55.3)	297/520 (57.1)

* The percentage of children watching TV/videos increased with increasing child age (Mantel Haenszel $\chi^2 = 124.2$ [*df* = 1]; *P* < .0001). Among 1-year-old children, the prevalence of children not watching TV/videos was higher among whites (29%) than Hispanics (11%), blacks (15%), or others (20%), ($\chi^2 = 31.0$, [*df* = 2]; *P* < .0001).

† Children's mean time viewing TV/video (hours per week) differed by race/ethnicity (*F* = 22.0 [*df* = 3; 2731]); *P* < .0001 by analysis of variance). Post hoc analysis using Scheffé's test showed that this significant overall *F* was attributable to differences between blacks and each of the other 3 racial/ethnic groups (all *P* < .05). Older children spent more time watching TV/videos than younger children (*F* = 93.0 [*df* = 3; 2752]; *P* < .0001 by analysis of variance). Post hoc analyses showed that all age groups, except the 2-year-old children versus the 3-year-old children, watched significantly different amounts of TV (all *P* < .05).

‡ The percentage of children watching more than an average of 2 hours per day of TV/videos increased with increasing child age (Mantel Haenszel $\chi^2 = 136.5$ [*df* = 1]; *P* < .0001) and also differed by race/ethnicity ($\chi^2 = 66.5$ [*df* = 3]; *P* < .0001).

differences in total viewing hours, the percentage of children watching TV/video 2 or more hours per day increased with increasing child age (Mantel Haenszel $\chi^2 = 137$ [$df = 1$]; $P < .0001$), and differed by race/ethnicity ($\chi^2 = 67$ [$df = 3$]; $P < .0001$; Table 2).

Children, whose parents had not completed high school spent more time (mean \pm SEM) watching TV/videos (15.8 \pm 0.7 hours per week) than children whose parents had completed high school (14.5 \pm 0.5 hours per week), attended college (14.5 \pm 0.5), or had a college degree (11.6 \pm 0.6 hours per week; $F = 4.9$ [$df = 3$; 2478]; $P < .002$ by analysis of variance). Girls and boys watched similar amounts of TV/videos (14.8 \pm 0.4 vs 14.7 \pm 0.5 hours per week, respectively; t value = 1.6 [$df = 2759$]; $P = .1$).

In multiple logistic regression, after statistical adjustment for child age, child sex, parental educational attainment, and race/ethnicity, the prevalence of overweight children was significantly related to the amount of time (hours per day) that the children spent watching TV/videos (Table 3). The odds ratio (OR) for the prevalence of children with a BMI >85th percentile associated with each additional hour per day that the children watched TV/videos was 1.06 (95% confidence interval [CI]: 1.01–1.15). In addition, Hispanics were significantly more likely to be overweight than a white reference group (OR: 1.54; 95% CI: 1.26–1.87). Interaction terms were added to the model but found to be nonsignificant. When nonsignificant covariates were dropped from the model, the OR for the prevalence of child overweight associated with each additional hour per day of TV/video watched was virtually unchanged (OR: 1.08; 95% CI: 1.03–1.13; $P < .004$), as was the OR for child overweight among Hispanics versus the white reference group (OR: 1.52; 95% CI: 1.29–1.79; $P < .0001$).

For those surveyed in 2000, each parent/guardian also reported his/her weight, height, and whether his/her child had a TV in his/her bedroom. More black children (51%) and more Hispanic children (50%) had a TV set in their bedroom than white children (20%) or other race children (31%; $\chi^2 = 120$ [$df = 3$]; $P < .0001$; Fig 2). Children with a TV set in their bedroom, compared with those without, spent an additional 4.6 per week watching TV/video (17.4 \pm 0.5 vs 12.8 \pm 0.3 hours per week; t value = 7.8 [$df = 1374$]; $P < .0001$). The prevalence of children with a BMI >85th percentile was also higher among

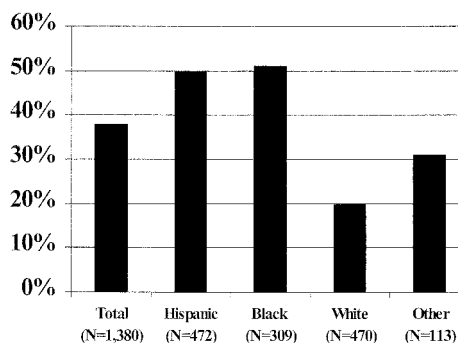


Fig 2. In the year 2000 Survey Data ($N = 1380$), the percentage of children with a TV set in their bedroom differed significantly by race/ethnicity ($\chi^2 = 120$ [$df = 3$]; $P < .0001$).

children with a TV in their bedroom compared with those without (44.4% vs 35.3%; $\chi^2 = 11$ [$df = 1$]; $P < .001$). In multiple logistic regression, children with a TV set in their bedroom were significantly more likely to have a BMI >85th percentile (OR: 1.31; 95% CI: 1.01–1.69; $P < .05$), after statistical adjustment for child age, child sex, race/ethnicity, maternal educational attainment, and maternal BMI group (Table 4). The OR for the prevalence of child BMI >85th percentile also increased with higher maternal BMI (OR: 1.85; 95% CI: 1.32–2.60, for $30 \leq \text{BMI} < 35$ kg/m²; and OR: 1.59; 95% CI: 1.07–2.35, for $\text{BMI} \geq 35$ kg/m²; $P < .02$).

CONCLUSION

In this study of low-income preschool children, we found that the amount of time spent viewing TV/video was significantly related to the prevalence of child overweight (BMI >85th percentile). Although direct comparisons to previous studies are difficult, the OR we observed of 1.06 (95% CI: 1.01–1.15) for the prevalence of child overweight associated with each additional hour per day of TV/video viewed is in good agreement with the OR of 1.12 (95% CI: 1.02–1.22) reported for Mexican children, aged 9 through 16 years.¹⁴ It also appears consistent with the reported 2% increase in prevalence of obesity for each additional hour per day of TV viewed by 12-through 17-year-old adolescents.^{6,8}

The mean weekly TV/video viewing times we observed (14.9, 16.3, and 18.4 hours per week for the 2-, 3-, and 4-year-old children, respectively) are comparable with the mean of 18.2 hours per week re-

TABLE 3. Multiple Logistic Regression: Child BMI for Age >85th Sex-Specific Percentile, Year 1999 and 2000 Survey Data ($N = 2761$)

Parameter	Estimate	P Value <	OR	95% CI
Intercept	-0.92	<.0001		
TV/video viewing (h/d)	0.06	.03	1.06	(1.01–1.15)
Child age (y)	0.04	.27	1.04	(0.97–1.12)
Child sex	0.05	.54	1.06	(0.90–1.24)
Parental educational attainment				
Less than high school	-0.09	.4	0.92	(0.76–1.12)
Some college	-0.13	.2	0.87	(0.72–1.06)
Black race	0.07	.54	1.07	(0.86–1.33)
Hispanic ethnicity	0.43	<.0001	1.54	(1.26–1.87)
Other race	-0.18	.25	0.83	(0.61–1.14)

White race, female child, and high school parental educational attainment are the reference groups.

TABLE 4. Multiple Logistic Regression: Child BMI for Age >85th Sex-Specific Percentile, Year 2000 Survey Data, Limited to Mother-Child Pairs (N = 1182)

	Parameter Estimate	P Value <	OR for Child Overweight	(95% CI)
Intercept	-0.86	.0001		
TV set in bedroom	0.27	.045	1.31	(1.01-1.69)
TV/video viewing (hours per day)	-0.01	.8	0.99	(0.91-1.08)
Child age (y)	0.04	.5	1.04	(0.93-1.16)
Child sex	0.01	.9	1.01	(0.80-1.28)
Maternal educational attainment				
Less than high school	-0.22	.13	0.80	(0.60-1.06)
Some college	-0.28	.07	0.75	(0.56-1.02)
Black race	0.12	.5	1.13	(0.81-1.59)
Hispanic ethnicity	0.44	.004	1.56	(1.16-2.10)
Other race/ethnicity	-0.47	.07	0.63	(0.38-1.04)
Maternal BMI (kg/m ²)				
25 ≤ BMI < 30	0.25	.10	1.28	(0.96-1.71)
30 ≤ BMI < 35	0.62	.0004	1.85	(1.32-2.60)
35 ≤ BMI	0.46	.02	1.59	(1.07-2.35)

Reference groups are female child, maternal BMI <25 kg/m², high school maternal educational attainment, white race, and no TV set in child's bedroom.

ported for 2- through 5-year-old children in the 1998 Annenberg National Survey.²⁶ Consistent with age trends, the younger preschool-aged children in this study watched fewer hours per week of TV/video than did older children in other studies,^{7,8,10,13} but more than the 14 hours per week reported in an earlier Canadian study of children aged 3 through 10 years.²² This may reflect time trends and/or differences between study populations.

We also found that the amount of time children spent watching TV/video was strongly influenced by demographic factors. As seen in studies of school-aged children and adolescents, black children spent the most time watching TV/videos, whereas the white children spent the least time.^{7,11,25} Although previous studies have reported that children's TV viewing varied inversely with parental educational attainment, we found in this low-income population that after statistical adjustment for racial/ethnic differences, parental educational attainment was no longer related to children's TV/video viewing.

Although the racial/ethnic distribution of the study population differed from the total WIC population at the surveyed agencies, most of the analyses were stratified by race/ethnicity or included race/ethnicity as a covariate. Thus, our findings are unlikely to be biased because of these differences. Our study population consisted entirely of children from low-income families, with relatively low parental educational attainment. This is both a limitation, as it limits generalizability of the findings, and a strength, because it decreases confounding by income level. It should be noted that the earliest studies linking TV viewing to obesity were among children with low-income, less educated parents,^{6,8} as was a recent Mexican study.¹⁴ In a study of sixth grade children, TV viewing and adiposity (triceps skinfold thickness in the boys and BMI in the girls) were found to be statistically associated among children from less affluent school districts, but not among those from more affluent school districts.³² A stronger association between TV viewing and obesity has also been observed among low-income, less educated women

than among high-income, more educated women.³³ Among the few studies of school children that failed to find a relationship between TV viewing and obesity, one study was conducted with a highly educated population,³⁴ while another gave no information regarding parental educational attainment or income level.²⁵

The relationship between TV viewing and adiposity may be stronger in low-income populations, or alternately, there may be other factors that covary with TV viewing and contribute to the risk of obesity that are present to a greater degree in low-income families. An Italian study of children aged 2 through 8 years reported that less-educated mothers had more positive attitudes about TV, believing that TV shows were instructive and stimulated interests, and had fewer concerns about negative values, such as exposure to violence.³⁵ Higher educated mothers were more likely to prohibit certain shows and monitor their child's TV use. Consequently, children of less-educated mothers not only watched more hours per week of TV but also had greater uncritical exposure to messages on TV. Children of higher educated mothers had less total TV exposure but also had qualitatively "better" exposure to TV programs because of greater parental selectivity of the programs watched.³⁵ Additional potential confounding factors might also include lower cognitive stimulation, which Strauss³⁶ suggests is an independent risk factor for the development of child obesity. It is possible that the increased rates of obesity associated with increased TV viewing might, in part, be mediated through the confounding effects of qualitative differences in the TV/video shows viewed and lower levels of cognitive stimulation, which are found more often in low-income populations. The relationship between TV viewing and obesity, however, is not found only among low-income populations. Two recent clinical trials in relatively highly educated populations demonstrated that reductions in TV/video viewing were associated with reductions in adiposity.^{17,18}

The findings that 38% of 1- through 4-year-old

children, 43% of third- and fourth- grade California children¹⁷ and 54% of sixth- and seventh-grade Boston children had TV sets in their bedroom²⁷ suggest a trend with age. These percentages, however, are higher than previously reported (31% of children, aged 2 through 5 years, and 34.5% of children, aged 6 through 11 years),²⁶ perhaps reflecting time trends. The differences we observed between the percentages of black, Hispanic, and white children with TV sets in their bedroom are only partially explained by differences in parental educational attainment. The children's living situations might contribute, in part, to the differences as the Hispanics and blacks in this study tended to live in metropolitan New York City where apartments are smaller than in upstate NY. Therefore, Hispanic children and Black children might be more likely than white children to share a bedroom with older siblings and/or parents.

Our finding that children with a TV set in their bedroom watched 4.8 hours per week more TV/video, than those without, is similar to the 4.5 hours per week (0.64 hours per day) difference noted for sixth- and seventh-grade children.²⁷ It is of note that a TV set in the child's bedroom was more strongly associated with increased risk of child overweight than the child's weekly TV/video viewing hours, after adjustment for potential confounders, including race/ethnicity, maternal education, and maternal obesity. The stronger association could be attributable to less measurement error in parental assessment of whether or not the child has a TV in his/her bedroom than in estimation of the child's usual TV/video viewing time. Alternately, children with a TV set in their bedroom might watch even more TV than parents are aware, or a TV in the bedroom might be a marker for other behaviors that contribute to and/or covary with child obesity.

In this study, we chose child BMI >85th percentile as the "overweight" criterion. The prevalence of child overweight, at risk of overweight, and/or obesity will vary depending on the definition or criteria used. Experts in the United States and worldwide have called for a standard definition for child overweight, recommending that sex-specific BMI for age percentiles be used to screen for children who are "overweight" or "at risk of being overweight."^{30,37} Strong correlation coefficients have been observed between BMI and both total body fat and percent of body fat (assessed using dual energy radiograph absorptiometry or hydrodensitometry), indicating that BMI can provide a general description of the adiposity characterization of a population. BMI, however, has been shown to be a poor predictor for the individual child.^{38,39} In children aged 1 to 7 years, decreases in BMI with age were primarily attributable to decreases in fat mass/stature,^{2,40} whereas in children aged 8 through 18 years, increases in BMI with age were attributable to increases in both fat-free mass/stature² as well as total body fat/stature.^{2,41} These associations also varied with gender and race/ethnicity.^{38,40} Because the relationship between BMI and percent fat among children has been evaluated only in blacks and whites, the validity of using BMI cutpoints to assess the prevalence of overweight sta-

tus among Hispanic children and other racial/ethnic groups requires additional study.

Because these study data are cross-sectional, causality cannot be inferred nor implied. Prospective studies, with more sociodemographically diverse populations and inclusion of other variables that contribute to the development of child obesity, such as paternal adiposity, child diet, parent-child feeding behaviors, and measures of child physical activity, are needed. Assessment of the types of TV shows or videotapes viewed, exposure to food advertisement, parental covieing, and measures of the cognitive stimulation of the child are also needed to further explore the association between TV/video viewing and overweight status among young preschool-aged children.

In our study population, most parents reported that their child "usually" watched TV/videos. Only 20% of the 1-year-old children did not watch TV/video, whereas 25% of 1-year-old children averaged >2 hours per day, despite recommendations by the American Academy of Pediatrics that TV viewing should be discouraged for this age group.^{42,43} Fifty-seven percent of the 4-year-old children in this study exceeded the recommended maximum media viewing time of 2 hours per day.^{42,43} It is possible that parents are not aware of the recent recommendations by the American Academy of Pediatrics, Committee on Public Education⁴³ or do not agree with them. Alternately, market forces encouraging parents to provide TV/video viewing opportunities for their young children may be more persuasive. Given that most 1-year-old children in this study are watching TV/videos, however, we need to understand why these recommendations are not being followed and what are parent's expectations and beliefs about TV viewing by young children. Only then can effective educational guidelines about TV viewing be developed and delivered by pediatric health care providers, WIC nutrition staff, public health educators, and other sources.

CONCLUSION

Our findings suggest that the previously observed association between TV viewing and increased risk of overweight extends to an even younger age group, 1- through 4-year-old children. Future studies are needed to determine whether reductions in TV/video viewing and/or removing TV sets from children's bedrooms will contribute to population-based efforts to prevent child obesity.

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