Exposure to Food Advertising on Television, Food Choices and Childhood Obesity

Tatiana Andreyeva, PhD
Associate Research Scientist
Yale University
Rudd Center for Food Policy & Obesity
309 Edwards Street
New Haven, CT 06520-8369
(203) 432-8432
tatiana.andreyeva@yale.edu

Inas Rashad Kelly, PhD
Assistant Professor of Economics
Queens College, City University of New York
65-30 Kissena Boulevard
Flushing, NY 11367
(718) 997-5440
inas.kelly@qc.cuny.edu

Abstract

To date, there has been insufficient research on the direct effects of food marketing on children's diet and diet-related health, particularly in non-experimental settings. In this paper we employ the nationally representative Early Childhood Longitudinal Survey – Kindergarten Cohort (ECLS-K) to estimate how various types of food advertising to children on television affect children's food consumption and body weight. Our study provides new estimates of the potential effect of food TV advertising on children's food choices and in turn body weight. We find evidence that soft drink TV advertising is related to increased consumption of soft drinks among elementary school children (Grade 5). Mild effects of exposure to food TV advertising on body weight can be seen, but overall results from these analyses are inconclusive.

I. INTRODUCTION

The Institute of Medicine (IOM) report on Food Marketing to Children and Youth calls for additional research to study the direct effects of food marketing to children on children's diet and diet-related health (IOM 2006). Prior research has demonstrated that the amount of media viewing is related to unhealthy diets and adiposity in young people (IOM 2006; Story and French 2004). The overwhelming majority of food advertisements targeted at youth is for foods of poor nutritional quality. For example, 97.8% and 89.4% of food-product ads viewed by children and adolescents respectively were high in fat, sugar, or sodium (Powell et al. 2007). Similarly, 59% of products that food manufacturers identify as appropriate to market to children do not meet a single, third-party nutrition standard (Batada and Wootan 2009). However, it is less well-established how exposure to food advertising influences children's food choices and diet-related health outcomes. Research on the causal effects of food marketing on children has been limited primarily to correlational studies whose findings could reflect alternative causal explanations (for example, parenting practices or child characteristics). As a result of limited studies, the IOM report concluded there was "weak evidence" that food marketing influenced dietary intake of children ages 6-11. Although the report provided "strong evidence" that exposure to television advertising was associated with obesity in 2- to 11-year-olds, the causal impact of food marketing on diet and obesity was not conclusively demonstrated.

Since the IOM report was issued, a few studies have begun to clarify the relationship between television viewing, food advertising, dietary intake and childhood obesity. One recent longitudinal investigation established that television exposure and correspondingly food advertising in middle and high school predicted lower consumption of fruits, vegetables and whole grains, as well as greater consumption of snack foods, fast food and sugar-sweetened

beverages five years later in life (Barr-Anderson et al. 2009). Epstein and colleagues (2008) conducted a randomized clinical trial to test an intervention to reduce young children's exposure to television and computers over a two-year period. The intervention successfully reduced children's screen use and resulted in a gradual reduction in body mass index (BMI) for children in the 75th or higher BMI percentile. The BMI reduction was entirely due to reduced calorie consumption; the intervention had no effect on overall sedentary behavior. A recent study by Zimmerman and Bell (2010) attributes the association between television viewing and childhood obesity to children's exposure to commercials that advertise unhealthy foods using data from child caregivers in 1997 and a follow-up in 2002. Finally, a recent economic analysis has found that exposure to fast food advertising increases adiposity in children, and estimated that banning fast food advertising to children would reduce the incidence of childhood overweight by 18% (Chou et al. 2008). Together, these studies suggest that exposure to food advertising on television may have significant effects on children's diet, body weight, and ultimately health.

Our study is designed to test the hypothesis that exposure to television advertising of fast food restaurants, soft drinks and cereal affects children's food consumption behaviors and BMI. We use national 2004 data from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) to estimate TV advertising attributable effects on food consumption and body weight among children in Grade 5 Drawing from The Nielsen Company 2002-2004 data on spot television advertising of cereals, fast food restaurants and soft drinks across the top 56 designated-market areas (DMAs), we estimate how exposure to food advertising on television, as measured by the Gross Rating Points (GRPs), is related to children's consumption of the advertised products, specifically fast food and soft drinks. Furthermore, we assess the direct effect of food advertising on body weight in children (measured by BMI z-scores). Our results

suggest that soft drink TV advertising is related to increased consumption of soft drinks among elementary school children (Grade 5). Mild effects of exposure to food advertising on TV on body weight can be seen, but overall results from BMI analyses are inconclusive.

II. DATA

Child-level data

The sample of elementary school-children is from the ECLS-K, a nationally representative sample of kindergartners in 1998-1999 who have been followed since kindergarten entry to the 8th grade. This multifaceted survey collected data from children, their parents, teachers and school administrators throughout the United States in the fall and the spring of kindergarten (1998-99), the fall and spring of 1st grade (1999-2000), the spring of 3rd grade (2002), the spring of 5th grade (2004), and the spring of 8th grade (2007).[1] The ECLS-K participants were selected via a multistage probability sampling design drawing from 100 primary sampling units (PSUs), which were geographic areas of counties or groups of counties selected with probability proportional to size. Within each PSU, the second stage were public and private schools that offered kindergarten programs, and finally the third-stage units were students that had equal probability to be selected within schools. Some racial/ethnic groups (e.g., Asians and Pacific Islanders) were oversampled. The original sample at kindergarten fall included 21,260 kindergartners (United States Department of Education, National Center for Education Statistics, 2001). The ECLS-K offers rich data on a wide range of family, school, community, and child characteristics that affect child development and school performance. Important for our study, the ECLS-K survey includes data on measured child's body weight and

[1] We exploit information for 8th graders in another paper, in addition to information on preschoolers from the Early Childhood Longitudinal Survey-Birth Cohort (ECLS-B).

height, TV viewing, food consumption (Grade 5 and 8), household income, family type, social program participation, and geographic identifiers (restricted-use data).

Food consumption measures were based on children's dietary self-reports in a child food consumption questionnaire that assessed overall intake of various foods and consumption of some foods and beverages on school premises. Specifically, soft drink consumption was assessed from children's responses to the question: "During the past 7 days, how many times did you drink Soda pop (EXAMPLES Coke, Pepsi, Mountain Dew), sports drinks (EXAMPLE Gatorade), or fruit drinks that are not 100% fruit juice (EXAMPLES Kool-Aid, Hi-C, Fruitopia, Fruitworks)?" There were seven answer choices, which were converted in a continuous measure of daily intake of soft drinks (including sports and fruit drinks) ranging from zero to four times a day. In the conversion, we used a mid-point for the range responses of "1 to 3 times during the past 7 days" and "4 to 6 times during the past 7 days". As the ECLS-K questionnaire did not distinguish between consumption of diet vs. regular (sugar-sweetened) beverages, we could not construct separate intake measures for sugar-sweetened and diet beverages. The fast food consumption question was phrased similarly: "During the past 7 days, about how many times did you eat a meal or snack from a fast food restaurant such as McDonald's, Pizza Hut, Burger King, KFC (Kentucky Fried Chicken), Taco Bell, Wendy's and so on?" with the same seven answer choices from no intake to four times a day. As with soft drinks, we converted the scale responses to construct a continuous measure of fast food daily intake (the number of times consumed per day). In addition to the individual measures of daily intake of fast food and soft drinks, we created a summary variable combining these measures. To adjust for the skewed nature of the distribution of food consumption (Figure 1), we took the natural log of all food consumption measures.

There were 11,278 participants in ECLS-K 2004, a much smaller sample compared to the original sample of kindergarteners due to the sample attrition. We dropped participants missing information for any of the following measures: body weight or height, consumption of fast food and soft drinks, residential location (zip-code), TV viewing, birth weight, socio-demographic characteristics of the child (age, gender, race/ ethnicity, family SES) and the child's mother (age, marital status). After these exclusions 9,760 children remained eligible for analysis.

Advertising data

We used The Nielsen Company Media data on GRPs for ready-to-eat cereal, regular and dietary carbonated soft drinks, and fast food restaurants at the category level for all Spot TV in the top 56 DMAs for children ages 6-11. A GRP measures the size of the audience in percent reached by a particular advertisement. For example, an advertisement that reaches 10 percent of its intended audience each time that has 100 spots in a year will have a GRP of 10*100=1000 for that year. Cereal, fast food and soft drinks are important contributors into children's diet and are also heavily marketed to children. These categories accounted for the majority of the total amount spent on marketing to youth by food and beverage companies in 2006 (Figure 2), with most spending on soft drink advertising targeted to adolescents and most spending on cereal advertising targeted to children ages 6-11 (FTC 2008).

The top 56 DMAs covered 70.746% of the total U.S. population, according to Nielsen's September 2008 U.S. TV Household Estimates. Depending on food category and year, our spot advertising data covered 68-86% of the total U.S. population in 210 DMAs. By analyzing the top 56 DMAs, we limit our focus to the most densely populated areas in the U.S. Our data provided annual totals of GRPs for the 2002, 2003 and 2004 calendar years. While we considered models with advertising exposure for each year separately (2002, 2003 and 2004), our preferred

estimation relied on the measures of cumulative exposure to food advertising on TV combining 2002 through 2004 GRPs for each product considered. For children living outside of the top 56 DMAs (N=4,040) and missing GRP data, we have constructed a dichotomous variable for missing advertising data. These children were more likely to be from rural areas and of lower socio-economic status.[2]

III. MODEL

We assess how exposure to television advertising of soft drinks, fast food restaurants, and cereals (measured by GRPs) is related to consumption of soft drinks, fast food, and a total of the two categories. Reduced form models identifying the effect of advertising directly on BMI are also estimated for advertising of cereals, fast food restaurants, and soft drinks.

We draw on variation in advertising exposure across DMAs to test differences in children's exposure to food advertising on television. In addition to soft drink and fast food consumption, we explore alternate outcomes that would not be plausibly influenced by our advertising measures as a counterfactual. These specification checks aid in attributing the effects we find to advertising and not to spurious correlation. This may be a concern due to the potential endogenous nature of advertising, in that food and beverage companies may choose to advertise where demand is higher. In their analysis of the effect of fast food advertising on BMI, Chou et al. (2008) addressed the potential endogenous nature of their advertising measures, using instrumental variables procedures and finding no evidence of endogeneity using the standard tests. Moreover, Gasmi et al. (1992) find that the soft drink industry is more cooperative than predatory in nature, which would render them more likely to capture demand that does not exist rather than capturing a competing company's demand.

[2] If these children are more likely to be influenced by food advertising, our estimates are likely to be conservative.

We estimate the following general model:

$$Outcome_{ijt} = \gamma_0 + \gamma_1 A_{ijt\,ijt} + \gamma_3 T_{ijt} + \gamma_4 X_{ijt} + \mu_j + \varepsilon_{ijt}$$

where the dependent variable ($Outcome_{ijt}$) is one of the following: soft drink consumption, fast food consumption, combined consumption of fast food and soft drinks or the body mass z-score for child *i* in DMA *j* surveyed in year *t*. All consumption measures are on the log scale. The primary explanatory variable pertains to the total GRPs for various commodities advertised on television over 2002-2004 to children ages 6 to 11 in DMA *j* (A_{ijt}). We also include the number of hours the child spent watching television per week (T_{ijt}), dichotomous variables for low and high birth weight (included in BMI regressions), a vector of demographic variables assessed in 2004 such as child's age in months and its second polynomial, race/ethnicity, gender, mother's age in years and its second polynomial, mother's marital status, household socio-economic status (SES) status (X_{ijt}), and vectors indicating U.S. Census regions (μ_j). ε_{ijt} denotes the error term. Standard errors are corrected using clustering at the DMA level to account for the aggregate nature of our advertising DMA-level measures.[3] Cross-sectional child-level weights are applied in all models to produce nationally-representative estimates. Table 1 defines all variables in the estimation and provides their descriptive statistics.

IV. RESULTS

Table 2 shows results where soft drink consumption is the outcome variable. The coefficients on advertising measures suggest that exposure to TV advertising of soft drinks is related to significantly higher soft drink consumption reported by 5th grade school-children. In

[3] We also estimate models separately by income, TV viewing and obesity status to assess possible interaction effects for these population groups. Results are qualitatively similar but imprecisely measured. They are available from the authors upon request.

particular, an increase in exposure to advertising of regular soft drinks by 100 GRPs is associated with an average 9.4% increase in total soft drink consumption. The same increase in advertising of diet soft drinks is associated with a much larger average increase of total soft drink intake by 84.5%. Furthermore, advertising of fast food restaurants is significantly related to soft drink consumption suggesting an average increase of 1.6% with a 100-GRP increase for fast food, which may reveal the complementary nature of the two products. When all advertising measures (fast food restaurants, cereal, and soft drinks) are included in the model, they are jointly significant ($p=0.011$) and advertising of both diet and regular soft drinks is positively related to soft drink consumption ($p<0.10$). Coefficients on the other explanatory variables included in Table 2 in general carry the expected signs. Males on average consume significantly more soft drinks, as do children who watch more television (although this variable is insignificant).[4] Children of Asian origin consume significantly less soft drinks than their peers.

Table 3 shows results where fast food consumption is the dependent variable. Coefficients on advertising measures are positive for the most part and significant at conventional levels. The advertising measures in the last model (column 5) are jointly significant at the 5% level. We speculate that the coefficients we obtain for fast food consumption may be underestimates, due to the phrasing of the fast food question versus that of the soft drink question. Children may not be sure if they have eaten fast food per se but are quite certain of whether they have consumed a soft drink.[5]

Table 4 presents results from estimations where we combine soft drink and fast food consumption to obtain a better picture of the child's overall diet. Specifically, soft drink advertising is associated with a 9.0% increase in children's consumption of soft drinks and fast

[4] Running models without television viewing does not alter the qualitative nature of our results.
[5] Note that the way the question was phrased, they need not answer that they have consumed fast food if it was bought from a cafeteria. So our measure of fast food consumption most certainly underestimates actual intake.

food (column 1), fast food advertising is related to a much smaller 1.4% increase (column 3), and all three advertising measures (soft drinks, fast food, and cereal) are jointly significant ($p<0.01$) (column 5).

Reduced form results predicting body weight (Table 5) fail to identify any relationship between food advertising and BMI z-scores, with the exception of a negative effect for cereal advertising ($p<0.10$). Coefficients on the other explanatory variables reveal low birth weight and high socioeconomic status to be significantly negatively correlated with BMI, while having a high birth weight, being male, Hispanic or of another race, and TV viewing are positively correlated with BMI, significant at conventional levels.

While fruit, vegetable, and milk consumption can plausibly be indirectly affected by advertising of less healthy foods due to displacement, we do not expect them to be highly affected; these measures thus serve as good specification checks. In Table 6, we document no significant effect of our advertising measures on fruit and vegetable consumption, and little effect on milk consumption (of cereal advertising). We find slight negative effects of advertising (fast food and soft drinks) on children's vigorous physical activity.

V. DISCUSSION

Research on food marketing to children has only recently gained momentum fueled in part by unprecedented growth in childhood obesity. Prior literature has demonstrated that exposure to food advertising on television may have significant effects on children's diet, body weight, and ultimately health. Relatively small but well-controlled experimental studies, larger correlational analyses and ultimately econometric designs permitting causal implications have provided evidence of various strengths that food marketing to children might be a contributor to

establishment of unhealthy diet habits in children and ultimately childhood obesity. Calls for more active government involvement in regulating food marketing to children became commonplace and launched efforts by legislators, legal experts, government agencies and public health advocates to establish restrictions on food marketing to children. For example, the Federal Trade Commission has taken a larger role in the issues related to food marketing to children. The inquiry by Connecticut Attorney General regarding the potentially misleading and deceptive Smart Choice labeling system (present on many foods targeted at children) have prompted the food industry to abandon the system.

Our study provides the next logical step in evaluating links between food advertising to children, their food choices and ultimately diet quality and health. Specifically, we find that exposure to TV advertising of regular soft drinks and diet soft drinks is positively related to consumption of sugar-sweetened beverages among 5th graders. We find these results regardless of whether we use advertising measures for regular soft drinks, diet soft drinks or a combination of both products. When we stratify results by income, we find income-based exceptions to the results for the whole sample: for example, 5th graders from high-income families do not seem to respond to soft drink advertising as much as their peers from lower-income families (no significant relationship between advertising and consumption). Children's exposure to advertising of fast food restaurants seems to have a more limited role in prompting children to consume more fast food. This could reflect the fact that children in our sample of fifth graders usually go to fast food restaurants with their parents. It is plausible that parental exposure to advertising plays a larger role in children's consumption of fast food than ads for fast food that children see.

The results on the relationship between exposure to TV food advertising and children's body weight are relatively weak and inconclusive. Cereal advertising appears to predict lower BMI z-scores among 5th graders. While it has been previously shown that 97.6% of cereal advertising viewed by children 2-11 years of age were for high-sugar cereals (Powell et al. 2007), there may be reasons for this negative effect. First of all, cereal consumption is strongly associated with the probability of child's eating breakfast. While the high-sugar cereal itself may not be deemed particularly healthy, the act of consuming breakfast is associated with healthy behaviors. Secondly, cereal consumption may displace soda and fast food consumption; that is, it may be considered a loose substitute good rather than a complementary one.

Furthermore, lack of association between advertising of soft drink and fast food restaurants with children's body weight outcomes may be partly due to BMI being a stock variable and less stable for children than adults. While the BMI z-score adjusts for child's age and gender, growth patterns differ drastically from child to child, we do not capture long-run changes in body weight. As an example of potential concerns with using BMI as a measure of child's health, obesity was found to be a very poor gauge of high cholesterol in children (Lee et al. 2009). In adults, it has been shown that fat-free mass, or body composition, is a more accurate measure of adiposity than BMI (Burkhauser and Cawley 2008; Wada and Tekin 2007).

The study findings are subject to some limitations. First, the survey consumption measures are based on children's self-reports, which are likely to underestimate actual intake, particularly for fast food. We also have no details on actual food intake (e.g., ounces per day), and cannot distinguish between diet and regular soft drinks or types of foods consumed at fast food restaurants. The share of diet beverages in all soft drinks for children is on average relatively low (about 10%, NHANES 2003-06). Another significant limitation of our analysis is

lack of advertising data for children not living in the top 56 DMAs (about 44% of our sample). Adding a dichotomous variable to indicate such children has no effect on our results, and the variable is also almost never statistically significant. Furthermore, we conduct estimation just for urban children who are no different regardless of whether they live inside or outside the top 56 DMAs; the results are qualitatively the same. Effects of advertising on alternative outcomes suggest that our significant findings are not due to spurious correlation.

Furthermore, while there might be concerns about evaluating delayed effects of exposure to advertising in our study (e.g., throughout 2002-2004 and consumption in 2004), there is evidence that young children's exposure to commercial television in 1997 affected children's BMI in 2002 (Zimmerman and Bell 2010). Even though we also estimate the association between GRPs in 2004 and food consumption and BMI outcomes in 2004, we believe the longitudinal component of our study with 3-year cumulative exposure measures makes it stronger and produces more interesting results. Marketing is a continuous process with delayed effects and companies spend billions of dollars to create lifetime habits and maintain them throughout the consumer's life.

Overall, the results from this study are consistent with few prior analyses suggesting that children's exposure to food advertising on television increases their consumption of the advertised products. As the overwhelming majority of food advertisements targeted at children are for energy-dense nutritionally-poor foods, excessive intake of such foods by children negatively affects the quality of their diet and may ultimately present risk for weight gain, development of obesity and related health conditions. In light of the epidemic growth in childhood obesity over the last several decades, the role of harmful exposure of children to advertising of nutritionally-poor foods is a serious public health concern.

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Table 1

Variable Definitions and Weighted Sample Means, ECLS-K

Variable	Description	Mean
BMI Z-score	Body Mass Index z-score in 5th grade	0.668 (1.113)
Log Soft Drink Consumption	Natural log of soft drink consumption (daily), adjusted for skewness	-0.533 (1.064)
Log Fast Food Consumption	Natural log of fast food consumption (daily), adjusted for skewness	-1.277 (1.120)
Log Soft Drink & Fast Food Consumption	Natural log of fast food and soft drink consumption (daily), adjusted for skewness	0.027 (0.893)
Regular Soft Drink Advertising	Regular Soft Drink spot TV GRPs for Children aged 6-11, 2002-04, from Nielsen (in hundreds)	0.696 (0.824)
Diet Soft Drink Advertising	Diet Soft Drink spot TV GRPs for Children aged 6-11, 2002-04, from Nielsen (in hundreds)	0.076 (0.088)
Cereal Advertising	Cereal spot TV GRPs for Children aged 6-11, 2002-04, from Nielsen (in hundreds)	1.746 (1.907)
Fast Food Advertising	Fast food service restaurants spot TV GRPs for Children aged 6-11, 2002-04, from Nielsen (in hundreds)	4.402 (4.844)
Male	Dichotomous variable that equals 1 if respondent is male	0.511 (0.500)
White Non-Hispanic	Dichotomous variable that equals 1 if respondent is white but not Hispanic	0.568 (0.495)
Black Non-Hispanic	Dichotomous variable that equals 1 if respondent is black but not Hispanic	0.159 (0.366)
Hispanic	Dichotomous variable that equals 1 if respondent is Hispanic	0.199 (0.400)
Asian	Dichotomous variable that equals 1 if respondent is Asian	0.030 (0.170)
Other Race	Dichotomous variable that equals 1 if respondent is of a race other than White, Black, Hispanic, or Asian	0.043 (0.204)
Age in Months	Age of respondent in months	134.782 (4.696)
Mother's Age in Yrs	Age of respondent's mother in years	38.682 (6.887)
Low SES	Low SES based on ECLS socioeconomic status variable created using family education, occupation, and family income (composite of 5 measures, each with mean=0 and s.d.=1)	0.206 (0.404)
Middle SES	Middle SES based on ECLS socioeconomic status variable created using family education, occupation, and family income (composite of 5 measures, each with mean=0 and s.d.=1)	0.597 (0.491)
High SES	High SES based on ECLS socioeconomic status variable created using family education, occupation, and family income (composite of 5 measures, each with mean=0 and s.d.=1)	0.198 (0.398)
Married	Dichotomous variable that equals 1 if	0.676

	respondent's mother is married	(0.468)
Single	Dichotomous variable that equals 1 if respondent's mother is single	0.123 (0.328)
Divorced	Dichotomous variable that equals 1 if respondent's mother is divorced or separated	0.201 (0.401)
TV Viewing	Child TV average daily viewing in hours, 5th grade	2.362 (1.245)
Low Birth Weight	Dichotomous variable that equals 1 if birth weight is less than 2500 grams	0.071 (0.257)
High Birth Weight	Dichotomous variable that equals 1 if birth weight is greater than 4000 grams	0.098 (0.298)
Living outside 56 top DMAs (missing advertising data)	Dichotomous variable that equals 1 if respondent does not live in one of the top 56 DMAs and has no advertising data	0.446 (0.497)

Note: Standard deviation is reported in parentheses. ECLS cross-sectional sample child-level weights are used in calculating the mean and standard deviation. Number of observations is 9,760.

Table 2
Relationship between TV Advertising and Soft Drink Consumption

VARIABLES	(1)	(2)	(3)	(4)	(5)
Regular Soft drink Advertising	0.0938***				
	(0.026)				
Diet Soft drink Advertising		0.8454**			
		(0.346)			
Fast Food Advertising			0.0157**		0.0012
			(0.008)		(0.011)
Soft Drink & Fast Food Advertising				0.0144**	
				(0.006)	
Cereal Advertising					0.0044
					(0.013)
Diet & Regular Soft Drink Advertising					0.0798*
					(0.041)
Male	0.1681***	0.1659***	0.1671***	0.1673***	0.1681***
	(0.036)	(0.036)	(0.035)	(0.035)	(0.035)
Black Non-Hispanic	-0.0393	-0.0356	-0.0347	-0.0360	-0.0399
	(0.092)	(0.091)	(0.091)	(0.091)	(0.092)
Hispanic	-0.0543	-0.0467	-0.0494	-0.0506	-0.0548
	(0.042)	(0.044)	(0.042)	(0.042)	(0.042)
Asian	-0.3150***	-0.3107***	-0.3078***	-0.3091***	-0.3158***
	(0.085)	(0.085)	(0.086)	(0.086)	(0.087)
Other Race	0.0166	0.0166	0.0192	0.0185	0.0158
	(0.069)	(0.069)	(0.069)	(0.069)	(0.068)
Age in Months	-0.0872	-0.0945	-0.0927	-0.0922	-0.0870
	(0.157)	(0.154)	(0.155)	(0.156)	(0.157)
Age in Months Sq	0.0004	0.0004	0.0004	0.0004	0.0004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's Age	-0.0217	-0.0218	-0.0228	-0.0226	-0.0218
	(0.021)	(0.021)	(0.022)	(0.022)	(0.021)
Mother's Age Sq	0.0002	0.0002	0.0002	0.0002	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Middle SES	0.0828	0.0837	0.0840	0.0839	0.0832
	(0.054)	(0.055)	(0.054)	(0.054)	(0.054)
High SES	-0.0832	-0.0823	-0.0850	-0.0847	-0.0838
	(0.067)	(0.067)	(0.066)	(0.066)	(0.067)
Single	-0.0689	-0.0668	-0.0671	-0.0670	-0.0679
	(0.071)	(0.071)	(0.072)	(0.072)	(0.072)
Divorced	0.0487	0.0483	0.0493	0.0495	0.0497
	(0.050)	(0.050)	(0.050)	(0.050)	(0.049)
TV Viewing	0.0271	0.0270	0.0268	0.0268	0.0270
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Living outside top 56 DMAs	0.0542	0.0535	0.0621	0.0724	0.0710
	(0.055)	(0.064)	(0.074)	(0.074)	(0.070)
Constant	4.9357	5.4434	5.3493	5.3028	4.9036
	(10.433)	(10.290)	(10.324)	(10.347)	(10.452)
Observations	9,760	9,760	9,760	9,760	9,760
R-squared	0.033	0.032	0.032	0.032	0.033
Advertising p-value					0.0110

Note: Dependent variable pertains to the natural log of children's soft drink consumption, adjusted for skewness. Robust standard errors are shown in parentheses. Controls for Census region are included in all regressions. Advertising p-value refers to the joint significance of advertising variables in column (5). Regressions are weighted and clustered by designated market area. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 3

Relationship between TV Advertising and Fast Food Consumption

VARIABLES	(1)	(2)	(3)	(4)	(5)
Regular Soft drink Advertising	0.0736***				
	(0.025)				
Diet Soft drink Advertising		0.4593*			
		(0.260)			
Fast Food Advertising			0.0109*		0.0015
			(0.006)		(0.009)
Soft Drink & Fast Food Advertising				0.0103**	
				(0.005)	
Cereal Advertising					-0.0152
					(0.016)
Diet & Regular Soft Drink Advertising					0.0706**
					(0.034)
Male	0.0530	0.0514	0.0522	0.0523	0.0524
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Black Non-Hispanic	0.2261***	0.2309***	0.2304***	0.2293***	0.2290***
	(0.064)	(0.063)	(0.064)	(0.064)	(0.063)
Hispanic	0.1234**	0.1301***	0.1278***	0.1268***	0.1273**
	(0.046)	(0.047)	(0.046)	(0.046)	(0.048)
Asian	-0.1427*	-0.1383*	-0.1369*	-0.1379*	-0.1380*
	(0.076)	(0.076)	(0.077)	(0.076)	(0.077)
Other Race	0.0267	0.0278	0.0289	0.0284	0.0290
	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Age in Months	-0.2162	-0.2206	-0.2202	-0.2199	-0.2213
	(0.141)	(0.141)	(0.142)	(0.142)	(0.141)
Age in Months Sq	0.0008	0.0008	0.0008	0.0008	0.0008
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's Age	-0.0260	-0.0264	-0.0269	-0.0268	-0.0258
	(0.032)	(0.033)	(0.033)	(0.033)	(0.032)
Mother's Age Sq	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Middle SES	-0.1715***	-0.1710***	-0.1707***	-0.1708***	-0.1719***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
High SES	-0.3054***	-0.3052***	-0.3068***	-0.3066***	-0.3036***
	(0.063)	(0.064)	(0.064)	(0.064)	(0.063)
Single	0.0552	0.0556	0.0561	0.0563	0.0539
	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
Divorced	0.0843**	0.0836**	0.0845**	0.0847**	0.0816**
	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)
TV Viewing 5th gr	0.0246	0.0246	0.0244	0.0244	0.0247
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Living outside top 56 DMAs	0.0879**	0.0579	0.0825*	0.0917*	0.0610
	(0.042)	(0.044)	(0.047)	(0.048)	(0.056)
Constant	13.8070	14.1381	14.1150	14.0847	14.1996
	(9.501)	(9.531)	(9.593)	(9.593)	(9.489)
Observations	9,760	9,760	9,760	9,760	9,760
R-squared	0.040	0.040	0.040	0.040	0.040
Advertising p-value					0.0457

Note: Dependent variable pertains to the natural log of fast food consumption, adjusted for skewness. Robust standard errors are shown in parentheses. Controls for Census region are included in all regressions. Advertising p-value refers to the joint significance of advertising variables in column (5). Regressions are weighted and clustered by designated market area. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 4

Relationship between TV Advertising and Fast Food and Soft Drink Consumption

VARIABLES	(1)	(2)	(3)	(4)	(5)
Regular Soft drink Advertising	0.0902***				
	(0.020)				
Diet Soft drink Advertising		0.7318**			
		(0.292)			
Fast Food Advertising			0.0139**		0.0007
			(0.006)		(0.009)
Soft Drink & Fast Food Advertising				0.0130**	
				(0.005)	
Cereal Advertising					-0.0080
					(0.013)
Diet & Regular Soft Drink Advertising					0.0853***
					(0.029)
Male	0.1224***	0.1203***	0.1213***	0.1216***	0.1220***
	(0.030)	(0.030)	(0.029)	(0.029)	(0.030)
Black Non-Hispanic	0.0999	0.1042	0.1048	0.1035	0.1015
	(0.072)	(0.071)	(0.071)	(0.071)	(0.072)
Hispanic	0.0214	0.0290	0.0265	0.0253	0.0236
	(0.036)	(0.038)	(0.037)	(0.037)	(0.037)
Asian	-0.2505***	-0.2459***	-0.2434***	-0.2446***	-0.2480***
	(0.080)	(0.080)	(0.081)	(0.081)	(0.081)
Other Race	0.0425	0.0429	0.0451	0.0445	0.0436
	(0.056)	(0.055)	(0.056)	(0.056)	(0.055)
Age in Months	-0.1264	-0.1329	-0.1314	-0.1310	-0.1294
	(0.122)	(0.120)	(0.121)	(0.122)	(0.121)
Age in Months Sq	0.0005	0.0005	0.0005	0.0005	0.0005
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother's Age	-0.0278	-0.0281	-0.0290	-0.0288	-0.0277
	(0.023)	(0.023)	(0.024)	(0.023)	(0.022)
Mother's Age Sq	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Middle SES	-0.0403	-0.0395	-0.0392	-0.0393	-0.0404
	(0.040)	(0.041)	(0.041)	(0.040)	(0.041)
High SES	-0.2201***	-0.2195***	-0.2218***	-0.2216***	-0.2191***
	(0.053)	(0.054)	(0.053)	(0.053)	(0.053)
Single	-0.0104	-0.0088	-0.0090	-0.0088	-0.0109
	(0.072)	(0.072)	(0.072)	(0.072)	(0.072)
Divorced	0.0622	0.0617	0.0626	0.0628	0.0608
	(0.038)	(0.037)	(0.038)	(0.038)	(0.037)
TV Viewing	0.0343*	0.0342*	0.0340*	0.0340*	0.0343*
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Living outside top 56 DMAs	0.0793*	0.0670	0.0771	0.0883	0.0670
	(0.041)	(0.049)	(0.057)	(0.057)	(0.056)
Constant	8.6625	9.1239	9.0462	9.0070	8.8894
	(8.040)	(7.971)	(8.026)	(8.044)	(8.017)
Observations	9,760	9,760	9,760	9,760	9,760
R-squared	0.047	0.046	0.046	0.046	0.047
Advertising p-value					0.0004

Note: Dependent variable pertains to the natural log of combined fast food and soft drink consumption, adjusted for skewness. Robust standard errors are shown in parentheses. Controls for Census region are included in all regressions. Advertising p-value refers to the joint significance of advertising variables in column (5). Regressions are weighted and clustered by designated market area. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 5

Relationship between TV Advertising and Body Mass Index Z Score

VARIABLES	(1)	(2)	(3)	(4)	(5)
Regular Soft drink Advertising	0.0123 (0.031)				
Diet Soft drink Advertising		0.1012 (0.318)			
Fast Food Advertising			0.0046 (0.006)		0.0108 (0.011)
Soft Drink & Fast Food Advertising				0.0037 (0.005)	
Cereal Advertising					-0.0259* (0.015)
Diet & Regular Soft Drink Advertising					-0.0089 (0.050)
Low Birth Weight	-0.2175** (0.089)	-0.2175** (0.089)	-0.2179** (0.088)	-0.2180** (0.088)	-0.2212** (0.089)
High Birth Weight	0.2964*** (0.072)	0.2962*** (0.072)	0.2968*** (0.072)	0.2967*** (0.072)	0.2963*** (0.072)
Male	0.1113** (0.047)	0.1111** (0.047)	0.1113** (0.047)	0.1114** (0.047)	0.1103** (0.047)
Black Non-Hispanic	0.0445 (0.091)	0.0451 (0.091)	0.0440 (0.091)	0.0439 (0.091)	0.0491 (0.091)
Hispanic	0.3297*** (0.044)	0.3307*** (0.045)	0.3294*** (0.044)	0.3293*** (0.044)	0.3358*** (0.044)
Asian	-0.0099 (0.066)	-0.0092 (0.065)	-0.0091 (0.065)	-0.0094 (0.065)	-0.0000 (0.066)
Other Race	0.1993** (0.077)	0.1994** (0.077)	0.1994** (0.077)	0.1993** (0.077)	0.2039** (0.076)
Age in Months	0.0018 (0.290)	0.0009 (0.289)	0.0004 (0.289)	0.0007 (0.289)	-0.0084 (0.287)
Age in Months Sq	-0.0000 (0.001)	-0.0000 (0.001)	-0.0000 (0.001)	-0.0000 (0.001)	0.0000 (0.001)
Mother's Age	0.0140 (0.027)	0.0139 (0.027)	0.0139 (0.027)	0.0139 (0.027)	0.0140 (0.027)
Mother's Age Sq	-0.0002 (0.000)	-0.0002 (0.000)	-0.0002 (0.000)	-0.0002 (0.000)	-0.0002 (0.000)
Middle SES	0.0136 (0.070)	0.0137 (0.069)	0.0139 (0.070)	0.0138 (0.070)	0.0133 (0.070)
High SES	-0.1107** (0.052)	-0.1106** (0.052)	-0.1110** (0.052)	-0.1109** (0.052)	-0.1083** (0.051)
Single	0.0439 (0.071)	0.0441 (0.070)	0.0449 (0.070)	0.0448 (0.070)	0.0429 (0.071)
Divorced	0.0449 (0.040)	0.0448 (0.040)	0.0454 (0.040)	0.0454 (0.040)	0.0410 (0.039)
TV Viewing	0.0910*** (0.019)	0.0910*** (0.019)	0.0909*** (0.019)	0.0909*** (0.019)	0.0911*** (0.019)
Missing advertising dummy	0.0565 (0.050)	0.0550 (0.052)	0.0786 (0.053)	0.0765 (0.053)	0.0385 (0.059)
Constant	0.3470 (19.627)	0.4110 (19.593)	0.4293 (19.604)	0.4109 (19.606)	1.1139 (19.398)
Observations	9,760	9,760	9,760	9,760	9,760

R-squared	0.050	0.050	0.050	0.050	0.050
Advertising p-value					0.3422

Note: Dependent variable pertains to the BMI z-score. Robust standard errors are shown in parentheses. Controls for Census region are included in all regressions. Advertising p-value refers to the joint significance of advertising variables in column (5). Regressions are weighted and clustered by designated market area. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Table 6

Specification Checks: Relationship between TV Advertising and Alternative Outcomes

VARIABLES	(1)	(2)	(3)	(4)	(5)
Dependent variable: Log of fruit and vegetable consumption					
Regular Soft drink Advertising	0.0172				
	(0.024)				
Diet Soft drink Advertising		0.2357			
		(0.220)			
Fast Food Advertising			0.0017		-0.0042
			(0.005)		(0.008)
Soft Drink & Fast Food Advertising				0.0018	
				(0.004)	
Cereal Advertising					0.0086
					(0.011)
Diet & Regular Soft Drink Advertising					0.0255
					(0.035)
Observations	9,760	9,760	9,760	9,760	9,760
R-squared	0.022	0.022	0.022	0.022	0.022
Advertising p-value					0.7706
Dependent variable: Log of milk consumption					
Regular Soft drink Advertising	0.0103				
	(0.025)				
Diet Soft drink Advertising		0.3238*			
		(0.191)			
Fast Food Advertising			0.0001		0.0004
			(0.005)		(0.006)
Soft Drink & Fast Food Advertising				0.0005	
				(0.004)	
Cereal Advertising					-0.0289***
					(0.009)
Diet & Regular Soft Drink Advertising					0.0281
					(0.024)
Observations	9,760	9,760	9,760	9,760	9,760
R-squared	0.044	0.045	0.044	0.044	0.046
Advertising p-value					0.0109
Dependent variable: Vigorous physical activity					
Regular Soft drink Advertising	-0.0708				
	(0.049)				
Diet Soft drink Advertising		-0.1479			
		(0.610)			
Fast Food Advertising			-0.0240*		-0.0412*
			(0.013)		(0.023)
Soft Drink & Fast Food Advertising				-0.0194*	
				(0.011)	
Cereal Advertising					0.0529
					(0.032)
Diet & Regular Soft Drink Advertising					0.0450
					(0.089)
Observations	9,567	9,567	9,567	9,567	9,567
R-squared	0.051	0.050	0.051	0.051	0.052
Advertising p-value					0.1385

Note: Robust standard errors are shown in parentheses. Standard controls included in Tables 2-4 are included in all regressions. Regressions are weighted and clustered by designated market area. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

Figure 1

Distribution of Fast Food and Soft Drink Consumption, ECLS-K

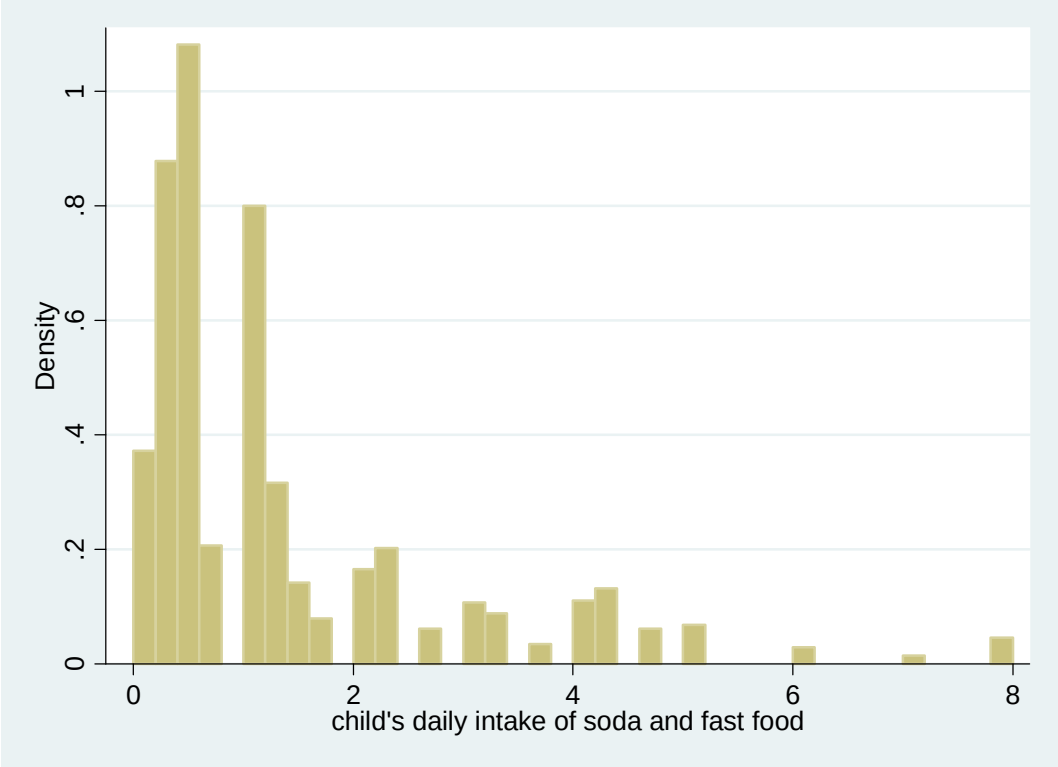
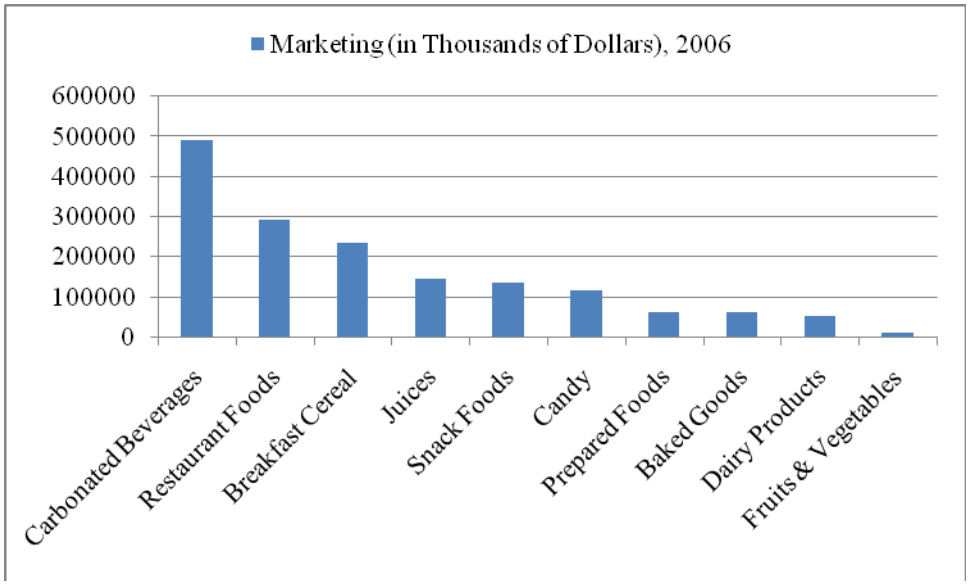


Figure 2

Total Youth Marketing for Reported Brands, 44 Companies



Source: Federal Trade Commission, Marketing Food to Children and Adolscents: A Report to Congress