

# bridging the gap

Research Informing Policies & Practices  
for Healthy Youth

## The Economics of Fast Food and Soda: Evidence and Policy Implications for Child and Adolescent Obesity

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**UIC** Institute for  
UNIVERSITY OF ILLINOIS  
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SCHOOL OF PUBLIC HEALTH

# Background: Fast Food Consumption

# Background -- Fast Food Consumption Patterns:

- Based on our analyses of 24 hr recall data from 2007-08 NHANES data:
- Among children aged 2-11,
  - 33% consume fast food on a given day (10% of TEI).
  - Of those that consume, intake of 576 kcal daily from fast food
- Among youths aged 12-19,
  - 41% consume fast food on a given day (17% of TEI).
  - Of those that consume, intake of 988 kcal daily from fast food

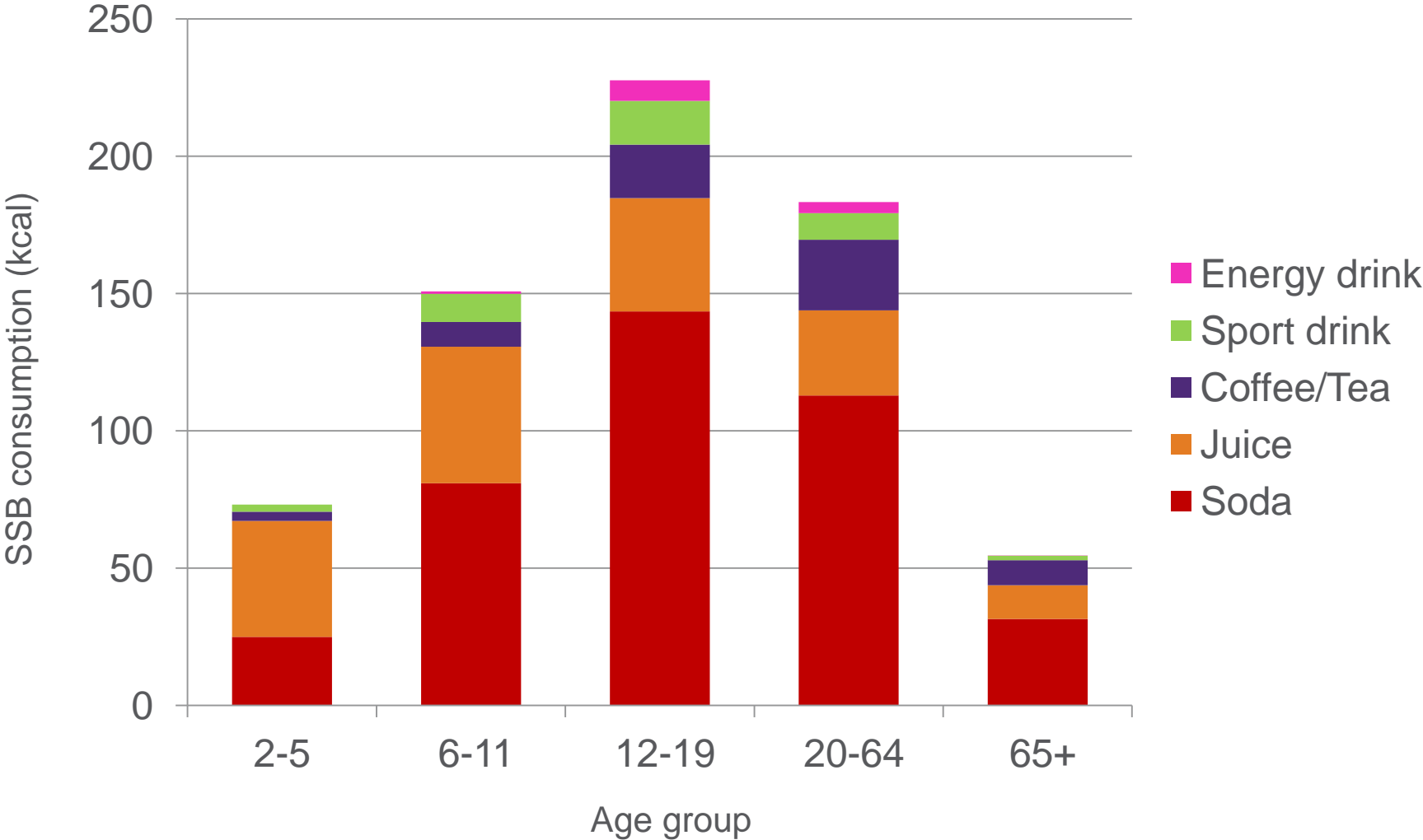
Source: Powell, Nygugen, and Han, under review 2012

# Background -- Fast Food Consumption Impacts:

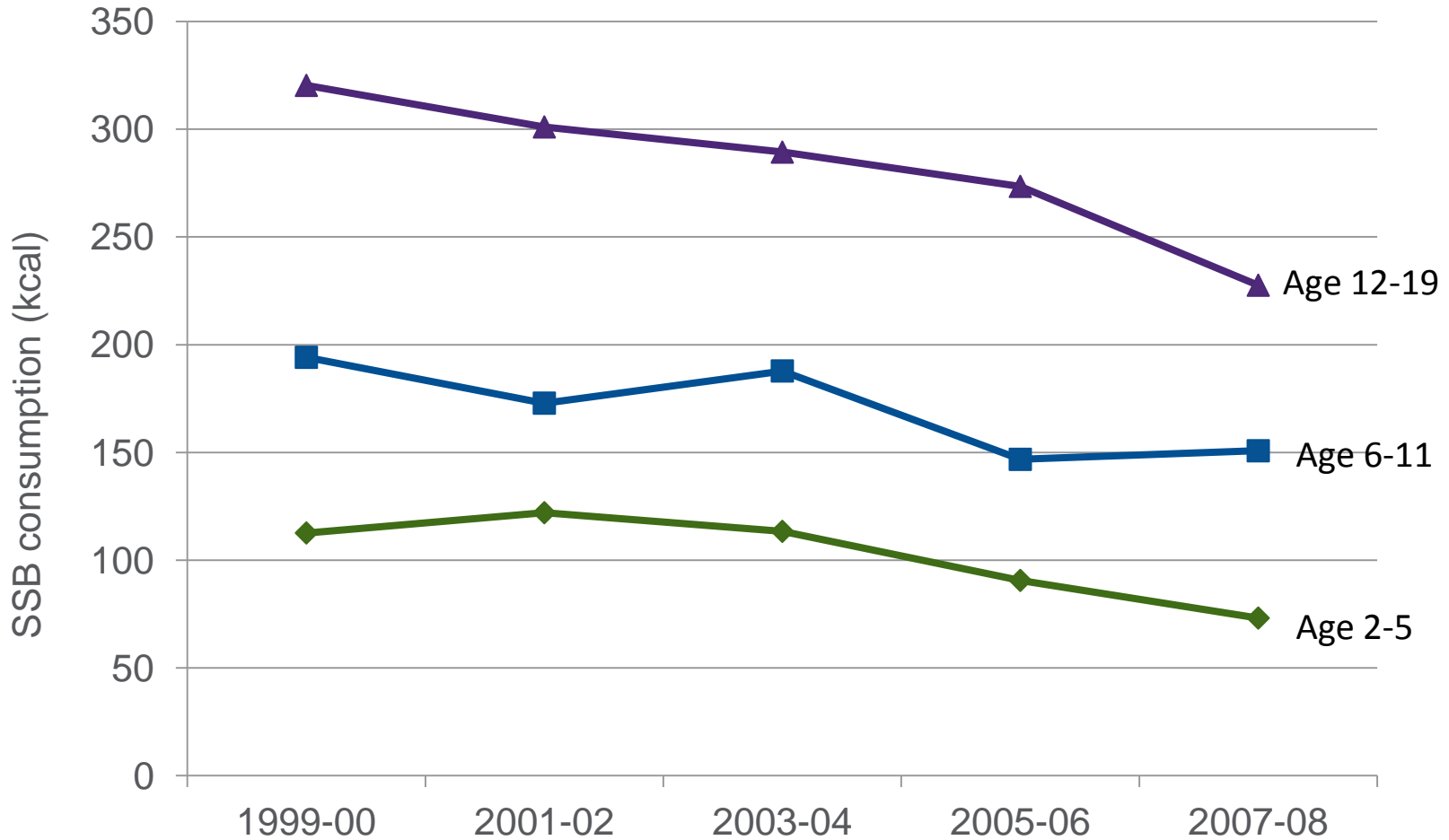
- First difference estimation based on 2 24 hr recalls reveal that fast food consumption is associated with:
  - **126 additional kcal** daily for children aged 2-11
  - **310 additional kcal** daily for youth aged 12-19

Source: Powell and Nygugen,, in progress 2011

# Background: U.S. Sugar-Sweetened Beverage Consumption Calories, by Age 2007-2008



# Background: SSB Consumption among Children & Adolescents, 1999-2008



Source: National Health and Nutrition Examination Survey (NHANES) 1999-2008, author's own calculations

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# Background from the Economic Tool Box

# Economic Models

❖ The economic framework assumes that individuals maximize utility (i.e., happiness) subject to time and budget constraints.

❖ Prices and wages

❖ Constraints

Budget

Time



# Economic Models

- ❖ Idea is that the policy instrument changes relative costs or benefits which, in turn, affect behavior choices related to diet and activity.
- ❖ Equity considerations: i.e., food taxes - who benefits versus who bears the costs.
  - Health benefits – progressive
  - Tax burden – regressive
  - Subsidies – progressive

# Modeling Issues

- Contextual measures may be endogenous (i.e. individuals who don't invest in their health and who like fatty food may choose to live in areas with more fast food restaurants).
  - Hard to find good IVs. For fast food: min wage; highway network
- Longitudinal data: control only for time-constant unobserved heterogeneity

# Cross-sectional vs. Longitudinal Estimation

## Cross-sectional estimation:

$$BMI_{ist} = \beta_0 + \beta_1 X_{it} + \beta_2 D_{it} + \varepsilon_{ist}$$

- ❖ Time fixed effects
- ❖ Geographic fixed effects

## Longitudinal estimation:

- ❖ Models to account for unobserved individual-level heterogeneity:

$$BMI_{ist} = \beta_0 + \beta_1 X_{it} + \beta_2 D_{it} + v_i + w_{ist}$$

- ❖ *Random Effects Models*: Assumes  $v_i$  and *independent variables* are not correlated
- ❖ *Individual Fixed Effects Models*: Difference out the constant individual-specific residual  $v_i$  and provide within person effects

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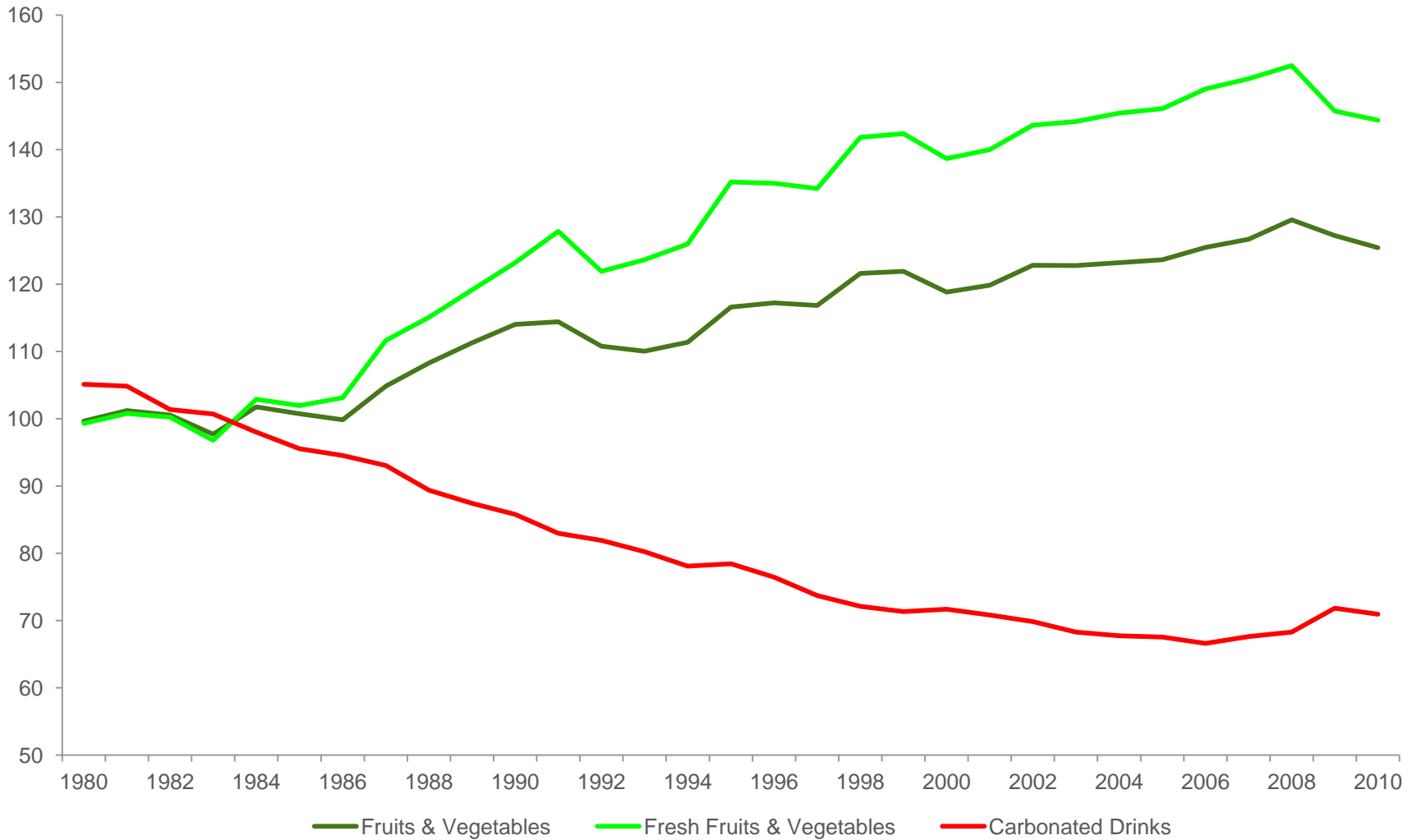
# Pricing

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# Trends in Food and Beverage Prices

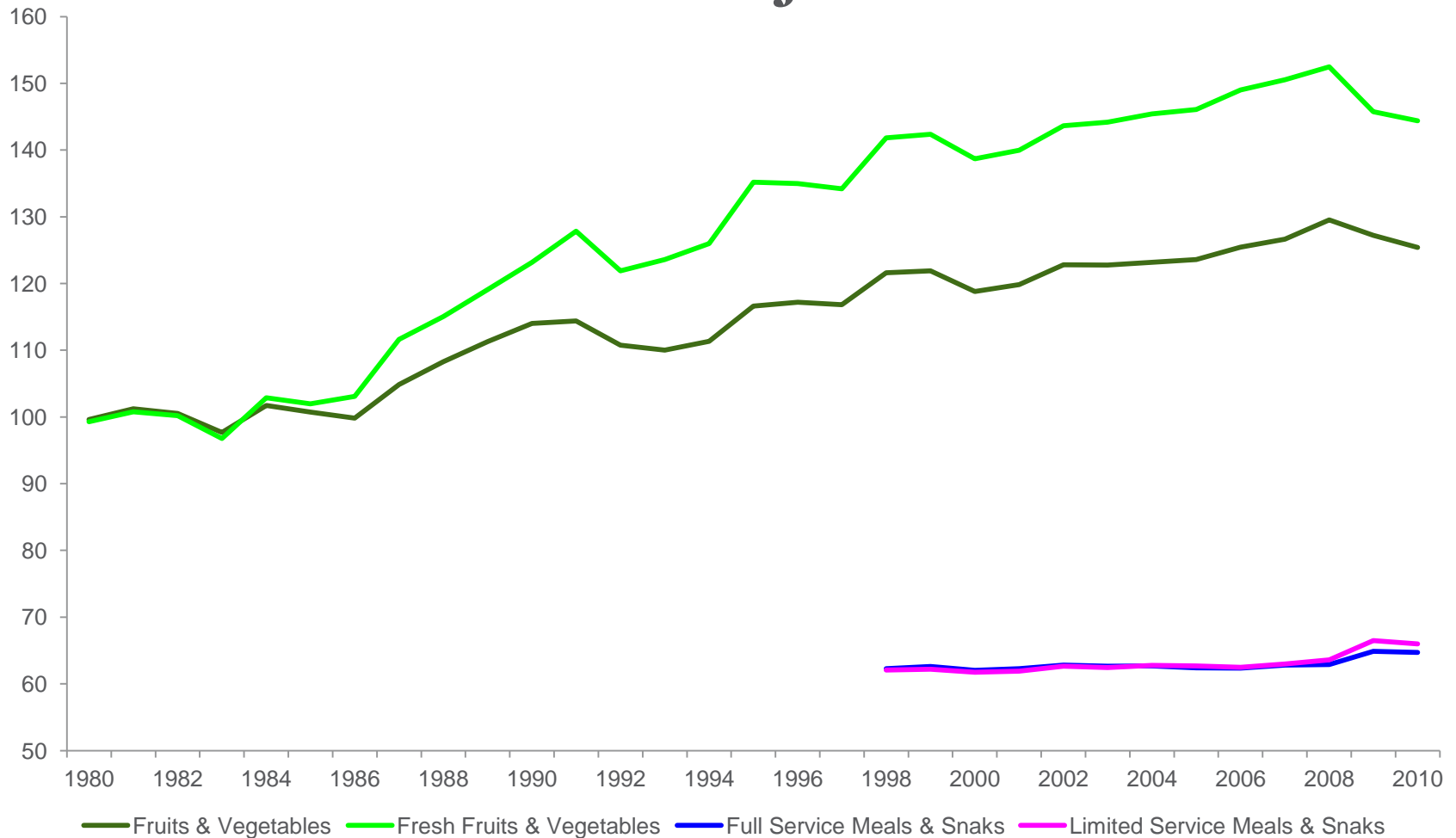
# Selected Food Price Trends, 1980-2010

## Inflation Adjusted



# Selected Food Price Trends, 1980-2010

## Inflation Adjusted



# Prices and Consumption

Background



## Background: Price Effects on Consumption

A recent review of studies on the impact of food and beverage prices on consumption of various products; estimates suggest 10% own-price increase would reduce:

- Soft drink consumption by 7.8%
- Food away from home consumption by 8.1%

USDA study on SSB and other beverage consumption estimates that a 10% price increase in SSB prices would result in the following changes in consumption :

Own-price effect:

- SSBs: -12.6%

Sources:

Andreyeva, T, M Long, and K. D. Brownell, "The impact of food prices on consumption: a systematic review of research on price elasticity of demand for food." *American Journal of Public Health*. 100 (2010): 216-222.

Smith, T. A., B.-H. Lin, and J-Y Lee. Taxing caloric sweetened beverages: Potential effects on beverage consumption, calorie intake, and obesity. Economic Research Report Number 100. 2010. United States Department of Agriculture, Economic Research Service.

# Food Prices: Consumption & Weight Outcomes

# Community Food Environment and Child/Youth Weight Outcomes: Data Linkage

## Individual-level data examples

- Monitoring the Future Data
- Children of the National Longitudinal Survey of Youth
- National Longitudinal Survey of Youth 97

## Linked by geocodes to:

- **Food prices from ACCRA**
  - *Fruit and vegetable price index*
  - *Food at home price index*
  - *Fast food price index*
- **Outlet density data from D&B**
  - *Fast Food and Full-service Restaurants*
  - *Supermarkets, Grocery and Convenience Stores*
- **Census Data**

# Evidence from MTF: Community Food Environment and Youth Fruit and Vegetable Consumption and BMI

- Find that:

- Youth in communities with lower fast food prices have less frequent fruit & vegetable consumption, higher BMI, and are more likely to be overweight
  - *10 percent rise in fast food prices would increase probability of frequent F&V consumption by 3%, reduce BMI by 0.4% and lower probability of being overweight by 5.9%*

Source: Powell, et al., *Advances in Health Economics and Health Services Research*, 2007

# Evidence from MTF: Community Food Environment and Youth BMI

- Find that:
  - Impact of both fast food and fruit & vegetable prices greatest among youth in top of BMI distribution (most at risk group)
    - *Above 90<sup>th</sup> percentile, fast food price impact 4 times larger than average effect for full sample*
    - *Above 95<sup>th</sup> percentile, fruit & vegetable price impact 5 times larger than average effect*
    - *Little impact of prices at low/mid-ranges of BMI*

Source: Auld and Powell, *Economica*, 2009

# Evidence from NLSY79: Price Elasticities of Child BMI by SES

	Fruit and Vegetable Price Elasticity of BMI	Fast Food Price Elasticity of BMI
Full Sample	0.0725*	-0.0667
By Family Income Quintile		
Low Income	0.1357*	-0.2565*
Near-low Income	0.0273	-0.0434
Middle Income	0.0837	-0.1544
Near-high Income	0.0564	-0.0629
High Income	-0.0042	0.2036
By Mother's Education		
Mother At Most High School	0.0927*	-0.1325*
Mother College or Above	0.0436	0.0234

\* Denotes statistical significance with p-value  $\leq 0.05$

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# Evidence from NLSY97: Fast Food Price BMI Elasticities: Individual-level Fixed Effects Model for Youths

Fast Food Price Elasticity of BMI	All	By Parental Income			By Mother's Education	
	Full Sample	Low Income	Middle Income	High Income	High School or Less	Some College or More
Price of Fast Food	-0.0782**	0.0658	-0.3130***	0.0547	-0.1338***	-0.0310

Source: Powell, *Journal of Health Economics*, 2009

# Summary of Associations with Child and Youth BMI

- Studies suggests that fiscal food pricing policies are likely to have modest but measurable effects, on average, on the weight outcomes of children and youths.
- Greater price sensitivity among:
  - Low-income children
  - Children with lower educated mothers
  - Youths who are in the upper tail of the BMI distribution
- The evidence suggests a multi-pronged approach of changing relative prices by simultaneously subsidizing fruits and vegetables and taxing fast food to improve weight outcomes among adolescents and low-SES children.



# Soda Taxes: Consumption & Weight Outcomes

Objectives, Data and Models

# Objectives

- To empirically examine the associations of state-level soda taxes with consumption and weight outcomes, using national data sets including:
  - A.C. Nielsen Homescan Data
  - Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K)
  - National Longitudinal Survey of Youth 1997 (NLSY97)

# Tax Data

- State level soda taxes from Bridging the Gap (BTG)
- Linked by state FIPS codes and year
- Measures used:
  - State-level soda tax rate
    - Disfavored tax rate (soda tax rate – general food tax rate)
    - Disfavored dichotomous indicator (indicator if disfavored tax rate >0)
  - State-level additional soda taxes/fees (dichotomous indicator)

# Soda Taxes and Consumption

A.C. Nielsen Homescan Data

# Objective

- To examine the association of soda taxes with household soda purchases

# Data Description

- Cross-section of household purchase information based on scanner data from a variety of stores, 2<sup>nd</sup> Q 2007
- Household demographic data
- Final sample includes 66,211 non-military households
- Outcome variable: soda volume in ounces of carbonated beverages purchased per household over the sample period (m=566 ounces ~ 2 cases of 12 oz cans)
- Control variables: household income, size, race, educational attainment, presence of children/age, female head of household employment status, and census regions

## Policy Simulation Example: Household Regular Soda Purchases

- Study results imply very small tax elasticities for purchases of -0.06.
- If all states increased sales taxes to the maximum tax rate of 7% (an increase of 60.6% from the current sample mean of 4.36%), household purchases of regular soda are estimated to be 3.6% lower.
- Consider the imposition of a **new 20% tax** → assuming constant elasticity, household regular soda purchases are estimated to be **27.5% lower**.
  - ❖ The extent to which this applies to all regular soda consumption depends on constant elasticity noted above, and whether regular soda consumed away-from-home is similarly price/tax responsive.

# Soda Taxes, Children's Consumption, and Weight

Early Childhood Longitudinal Study-Kindergarten Cohort

## Objective

- To examine association between soda taxes, consumption and weight of children

## Data Description

- Nationally representative panel of elementary school students.
- Food consumption 5<sup>th</sup> grade; measured height and weight
- Final sample: 7,414 children who reported their food consumption and 7,300 children for which height and weight information exists
- Outcome variables: soda consumption in last week (m=6), soda purchases at school (m=0.4), and weight change 3<sup>rd</sup> to 5<sup>th</sup> grade (m=1.9)
- Control variables: age in months, race/ethnicity, family income, mother's education level, physical activity, TV watching, parent-child interactions.



# Policy Simulation Example: Children's BMI

- Assuming a constant elasticity, an 18% differential soda tax would correspond to a -0.23 BMI units in the change in BMI between 3<sup>rd</sup> and 5<sup>th</sup> grade, or a 20% reduction in the excess BMI gain.

# Soda Taxes and Adolescents' Weight

National Longitudinal Survey of Youth 97

# Objective

- To examine association of soda taxes with youths' BMI using cross-sectional *and* longitudinal models

# Data Description

- Nationally representative longitudinal data on youth aged 12 to 17 in 1997; 4 waves of including 1997, 1998, 1999 and 2000
- Estimation sample includes 18,029 person-year observations living at home
- Information on parental characteristics available from parental questionnaire and annual household roster data
- Outcome variable: weight status: BMI and overweight prevalence
- Control variables: age, gender, race, ethnicity, income, mother's education, mother's employment status
- Neighborhood controls: median household income

# Longitudinal Regression Estimates of the Determinants of Adolescent BMI

	BMI
Continuous disfavored state soda tax rate	-0.220**
Presence of additional state soda taxes/fees	-0.230***

Source: Powell & Chriqui, in progress, 2011

# Longitudinal BMI Soda Tax Estimates by Alternative Specifications

Model	State Tax/Fee	County-Level Median Household Income	Model 1 (Continuous Disfavored Soda Tax Rate)	Model 2 (Presence of Disfavored Soda Tax)
RE	✓	✓	-0.220**	-0.088**
RE	X	✓	-0.190*	-0.076*
RE	✓	X	-0.216**	-0.087**
RE	X	X	-0.188*	-0.075*
FE	✓	✓	-0.235*	-0.094*

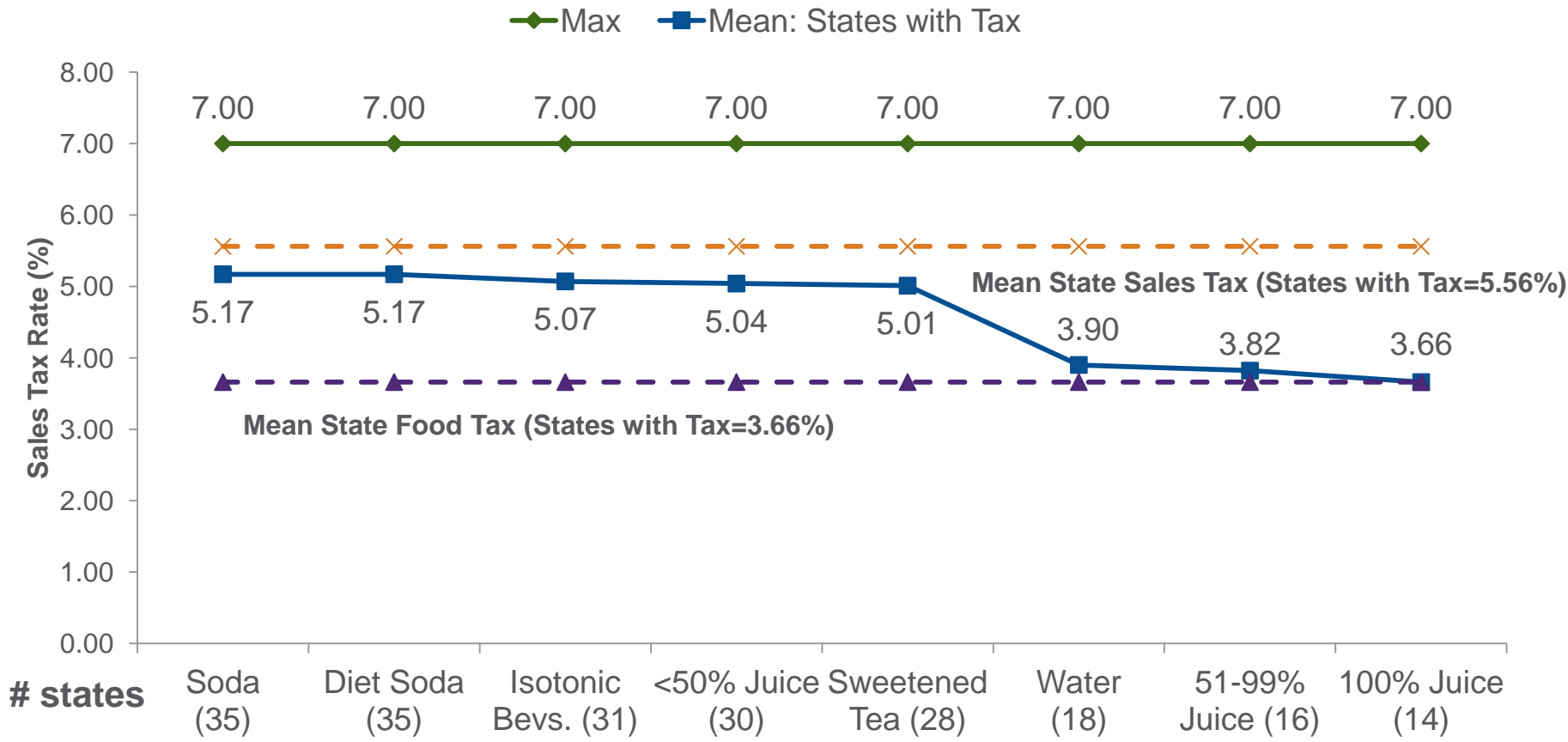
Source: Powell & Chriqui, in progress, 2011

# Summary of Empirical Results

- Generally moderate associations between soda taxes and body weight based on the existing low tax rates which range up to just 7% in the study sample.
- *Substantial* increases in soda tax rates may have some measureable effects on BMI and even greater effects at the population level.
- Disfavored soda tax elasticity of BMI is estimated to be -0.029.
  - Doubling the disfavored tax rate (~3% to ~6%) is estimated to reduce BMI by 2.9%.

# Policy Implications

# Sales Taxes on Selected Beverages, Taxing States (as of July 1, 2011)

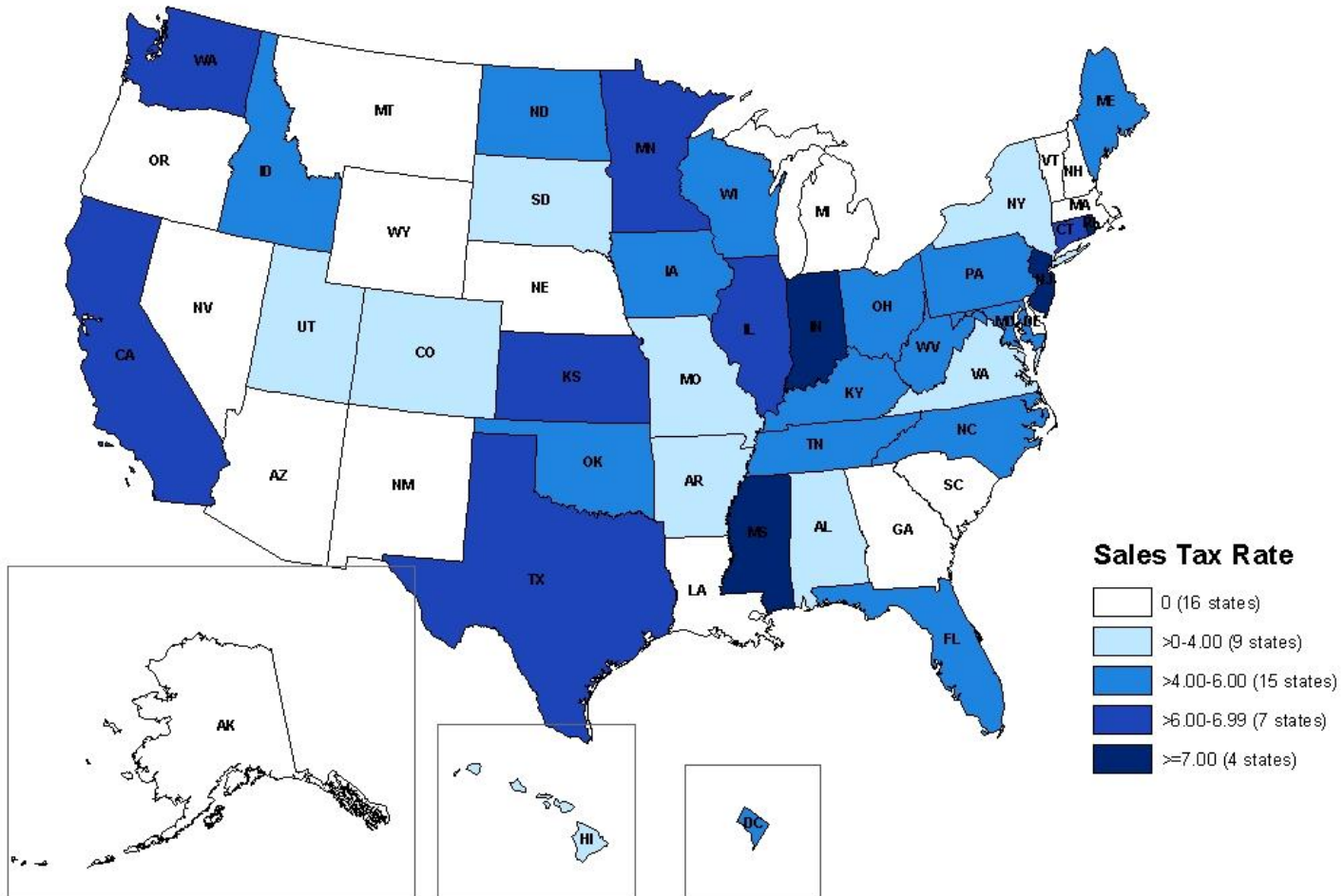


**Note:** Three states also impose a mandatory statewide local tax that is not reflected in the above data: CA (1%), UT (1.25%), VA (1%).

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## State Regular, Sugar-Sweetened Soda Sales Tax Rates (as of July 1, 2011)



Note: Does not include 3 states with mandatory, statewide local tax rate (CA-1%, UT-1.25%, VA-1%)

Data Source: Bridging the Gap Program, University of Illinois at Chicago, 2011

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# Selected Examples of State SSB-related Legislative Activity 2011/12

**California** (\$0.01/ounce tax on tax on distributors of SSBs; revenue to create Children's Health Promotion Fund) – **Held (failed to pass) in Committee 9/23/2011**

**California** (to authorize any county or city to propose to voters a \$0.01/ounce excise tax on SSBs) – **Died in Committee 2/9/2012**

**Hawaii** (\$0.01 per teaspoon tax on SSBs; revenue to community health centers and trauma system special funds)

**Illinois** (\$0.01/ounce tax on SSBs; revenue to create Illinois Health Promotion Fund)

**Nebraska** (sales tax on SSBs; revenue to Obesity Prevention Fund)

**Rhode Island** (\$0.01/ounce, revenue to funds programs to reduce obesity)

**Tennessee** (\$0.01/ounce tax on bottled SSBs in exchange for 1% reduction in state sales tax on food – referred to as 'swap legislation')

**Vermont** (\$0.01/ounce tax on SSBs; revenue to create Vermont oral health improvement fund)

**West Virginia** (series of taxes on bottled soft drinks, syrups and dry mixtures; revenue for construction, maintenance and improvements of state parks)

# Future Research and Tax Policy Design Implications

- Evidence as we go ... jurisdictions that adopt higher taxes on sugar sweetened beverages will provide natural experiments for researchers to examine the effectiveness of these efforts in promoting healthier dietary intake and curbing the obesity epidemic.
- Tax Policy Design: Implications for Potential Impact on Health Outcomes
  - ❖ Issues of applicability to SNAP purchases
  - ❖ Excise tax rather than a sales tax
    - Incorporated at shelf price
    - Applicable regardless of where items are sold
    - Applied on a per unit basis rather than a function of price so that quantity discounts are still taxed. Issue of zero marginal cost for free refills.
  - ❖ Dedication of tax revenue to nutrition and physical activity programs

# Promotion

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# TV Advertising Content

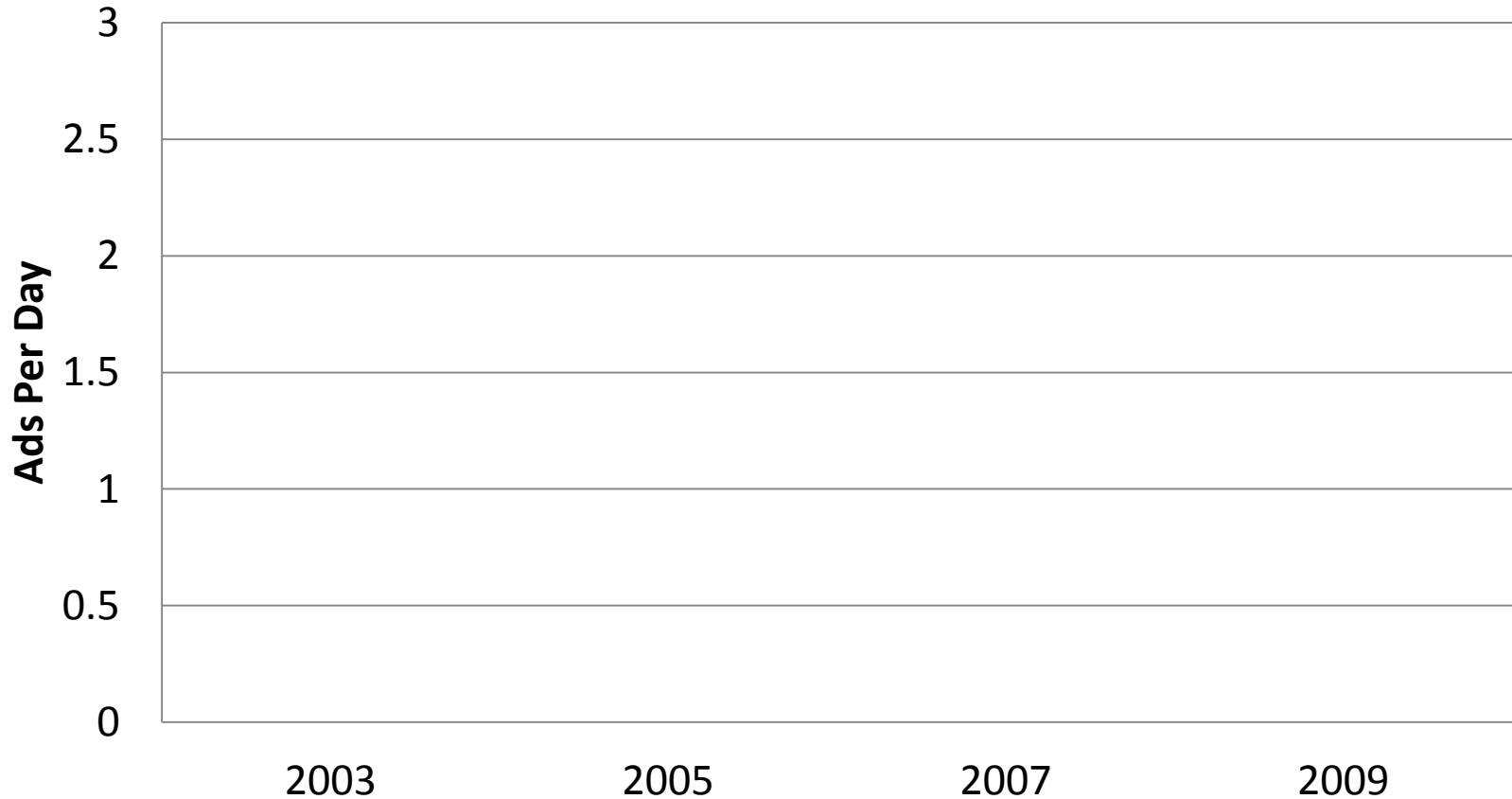
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# Advertising Data

- Targeted Ratings Points (TRPs) data on exposure to ads seen on TV obtained from Nielsen Media Research
- Ratings cover all programming seen by children
- Ratings points measure the reach and frequency of advertising. For example, a commercial with 80 TRPs for 2-5 year olds per month is estimated to have been seen an average of one time by 80% of children 2-5 over the defined period
- Ratings by:
  - Year: 2003, 2005, 2007, and 2009
  - Age Groups: 2-5y, 6-11y, and 12-17y
  - Race: All children, separately by white and black. Study does not include separate ratings for Hispanic children nor does it cover Spanish Language TV
- Food-related advertising categorized as:
  - Cereal, Sweets, Snacks, Beverages, Fast Food Restaurants, Full-service Restaurants, and Other

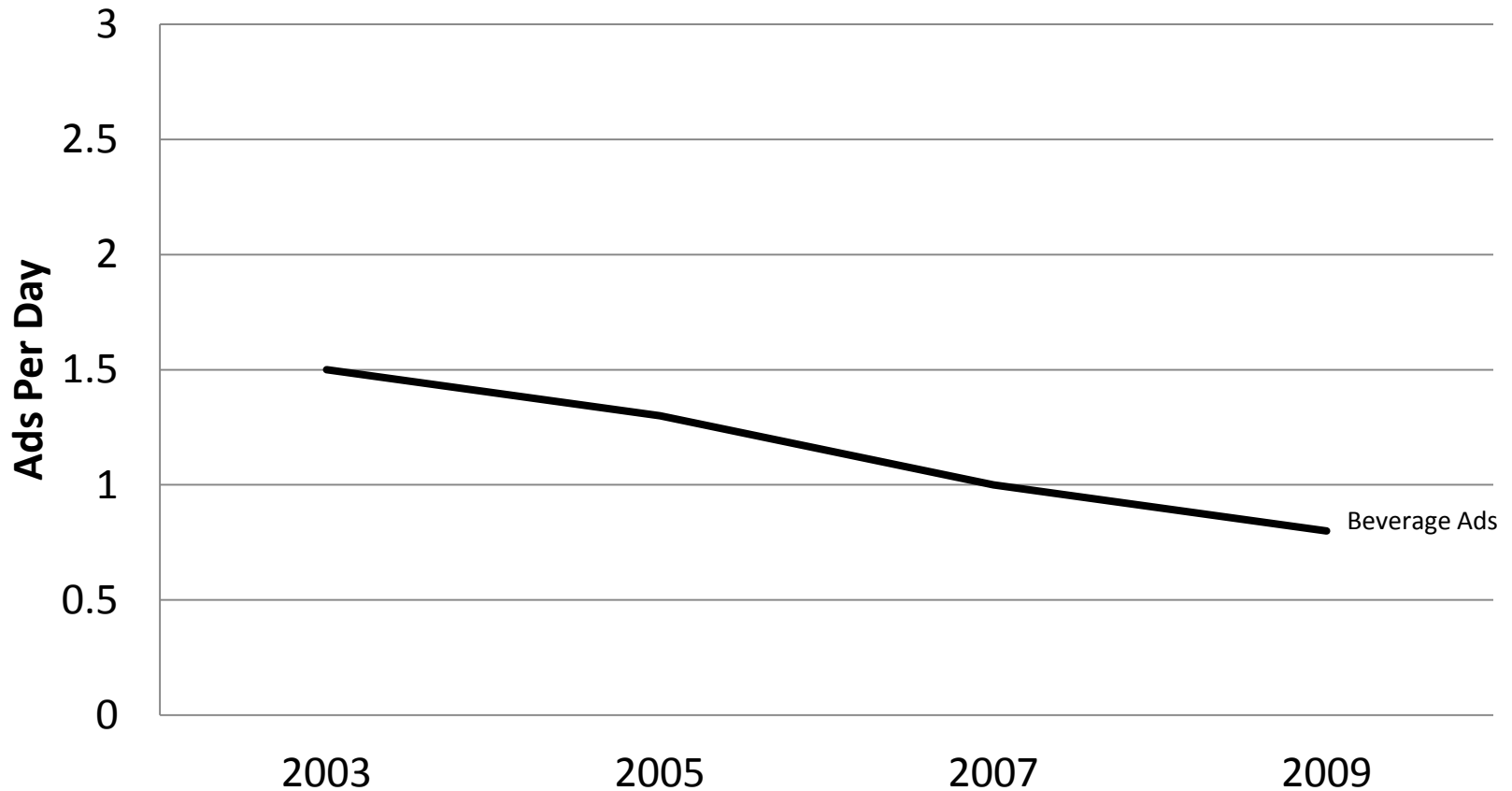
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 2-5 Years



# Exposure to Food Advertisements per Day for Children by Year

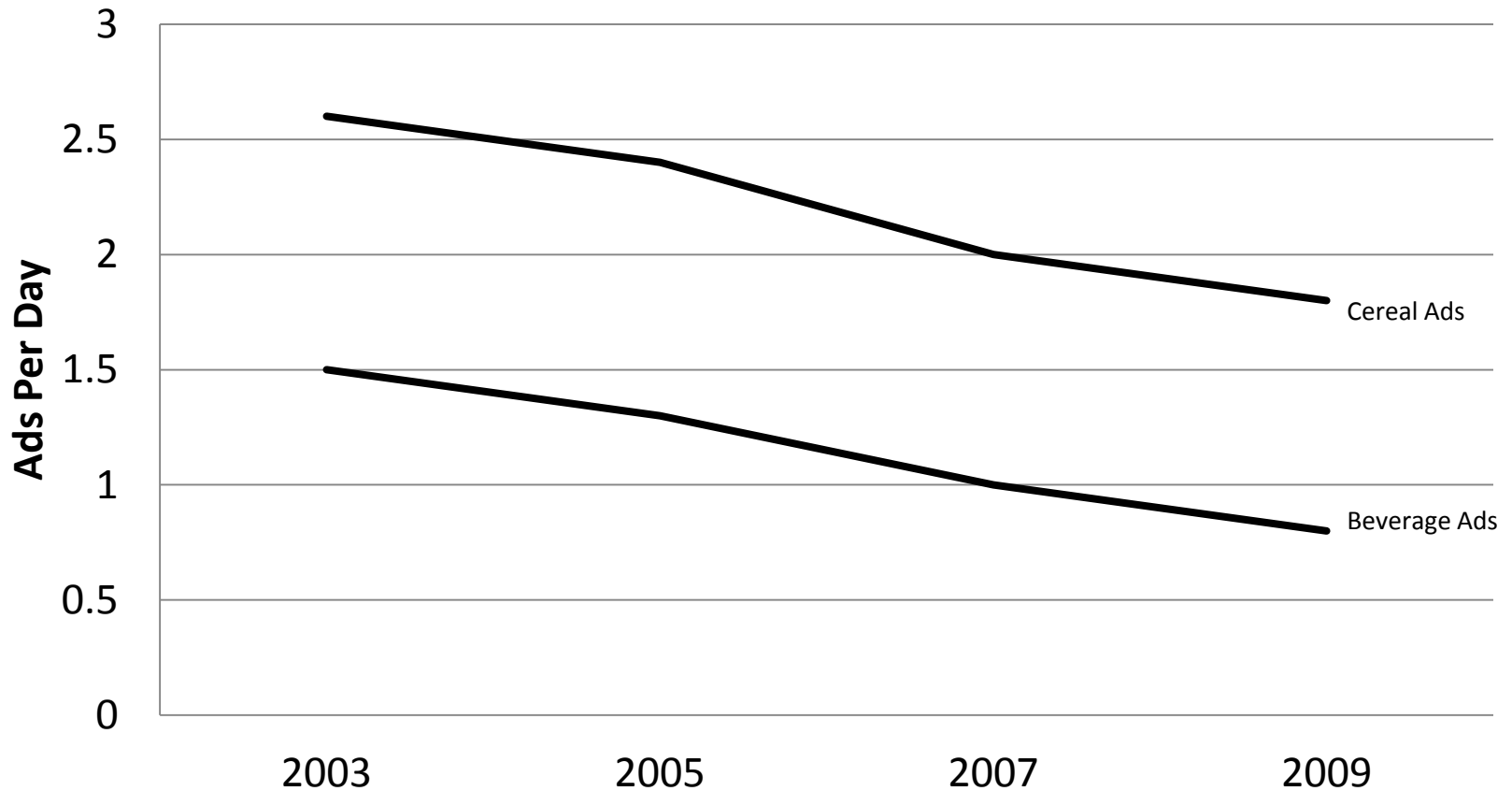
## Children Ages 2-5 Years





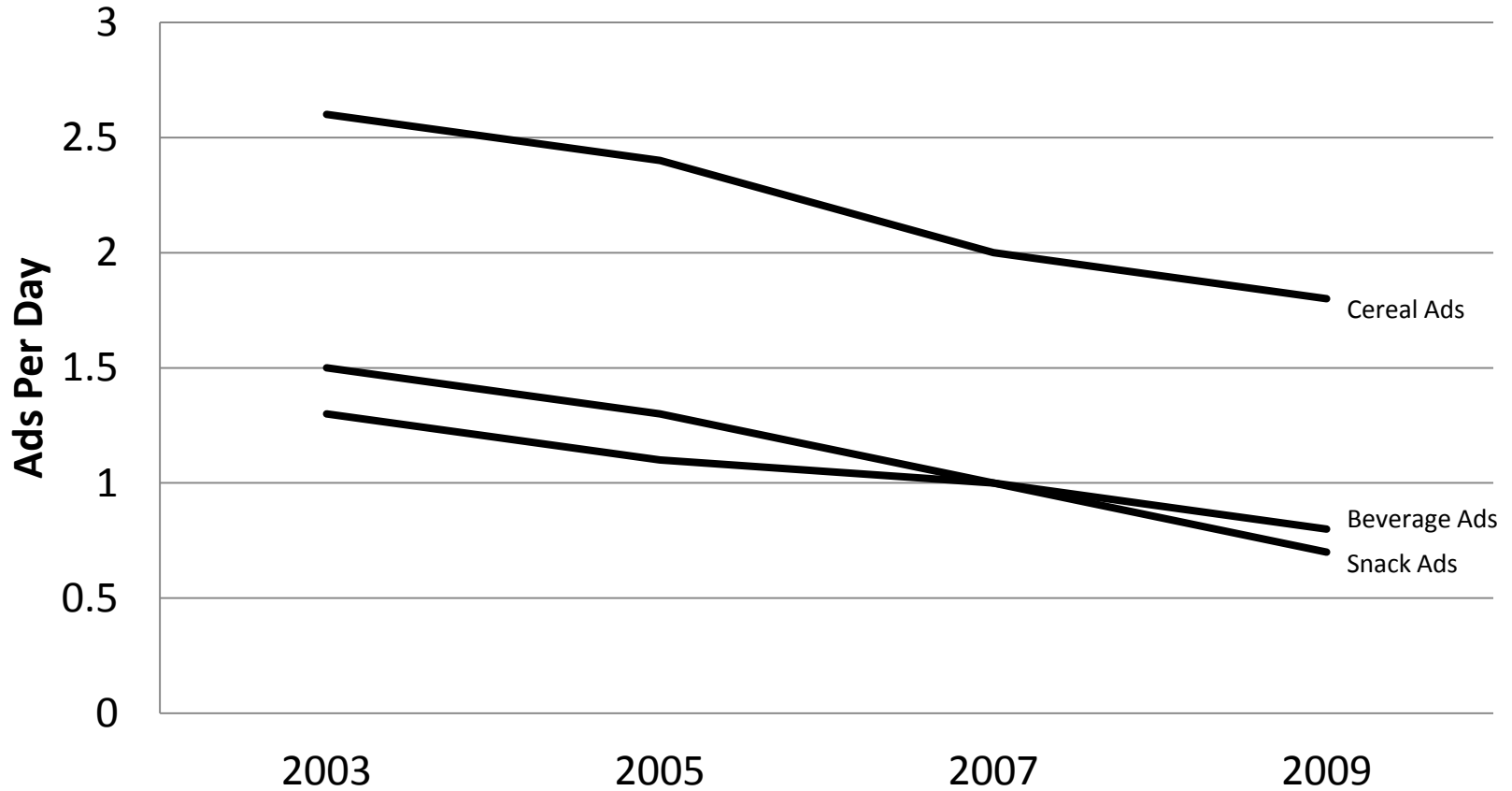
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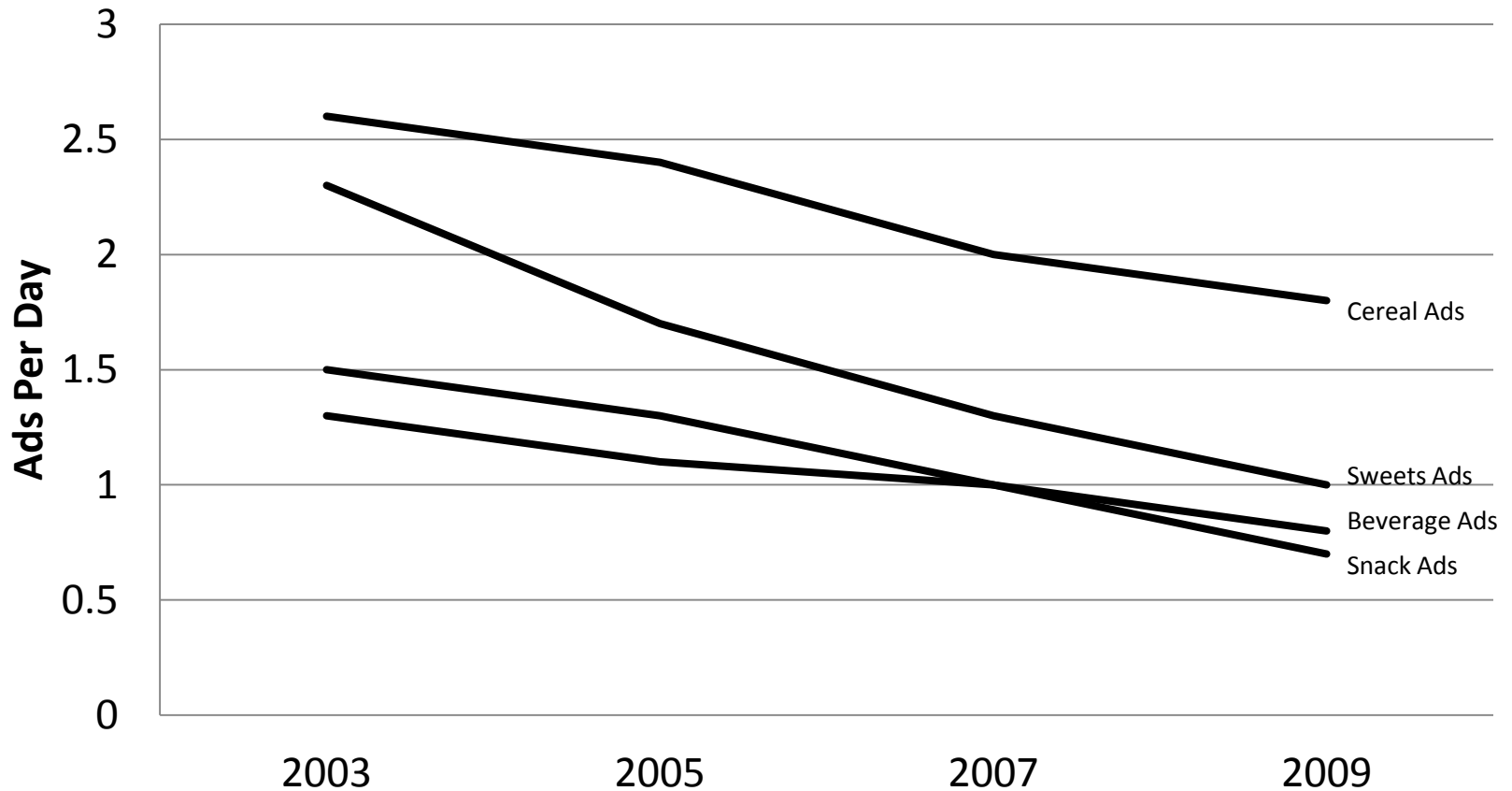
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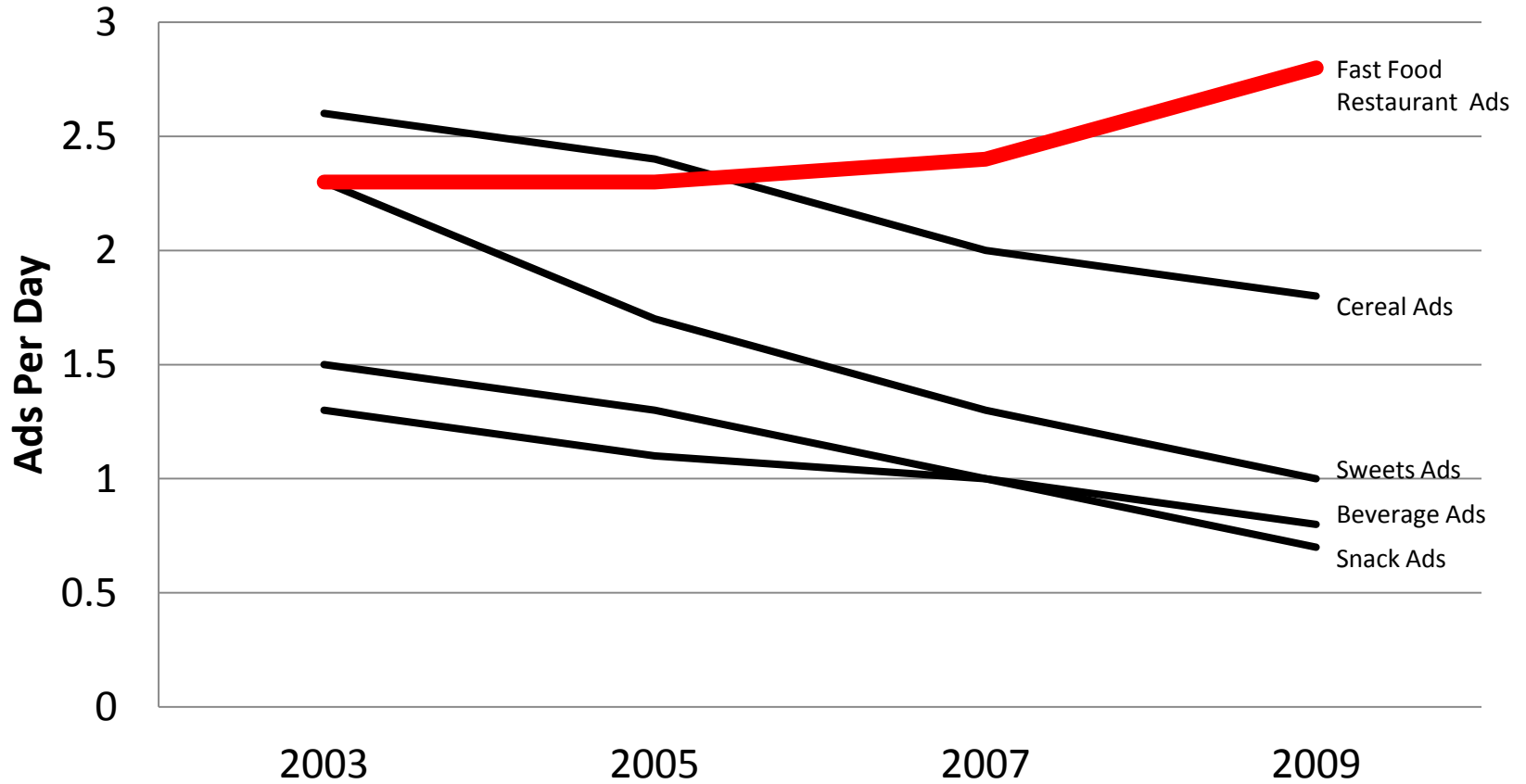
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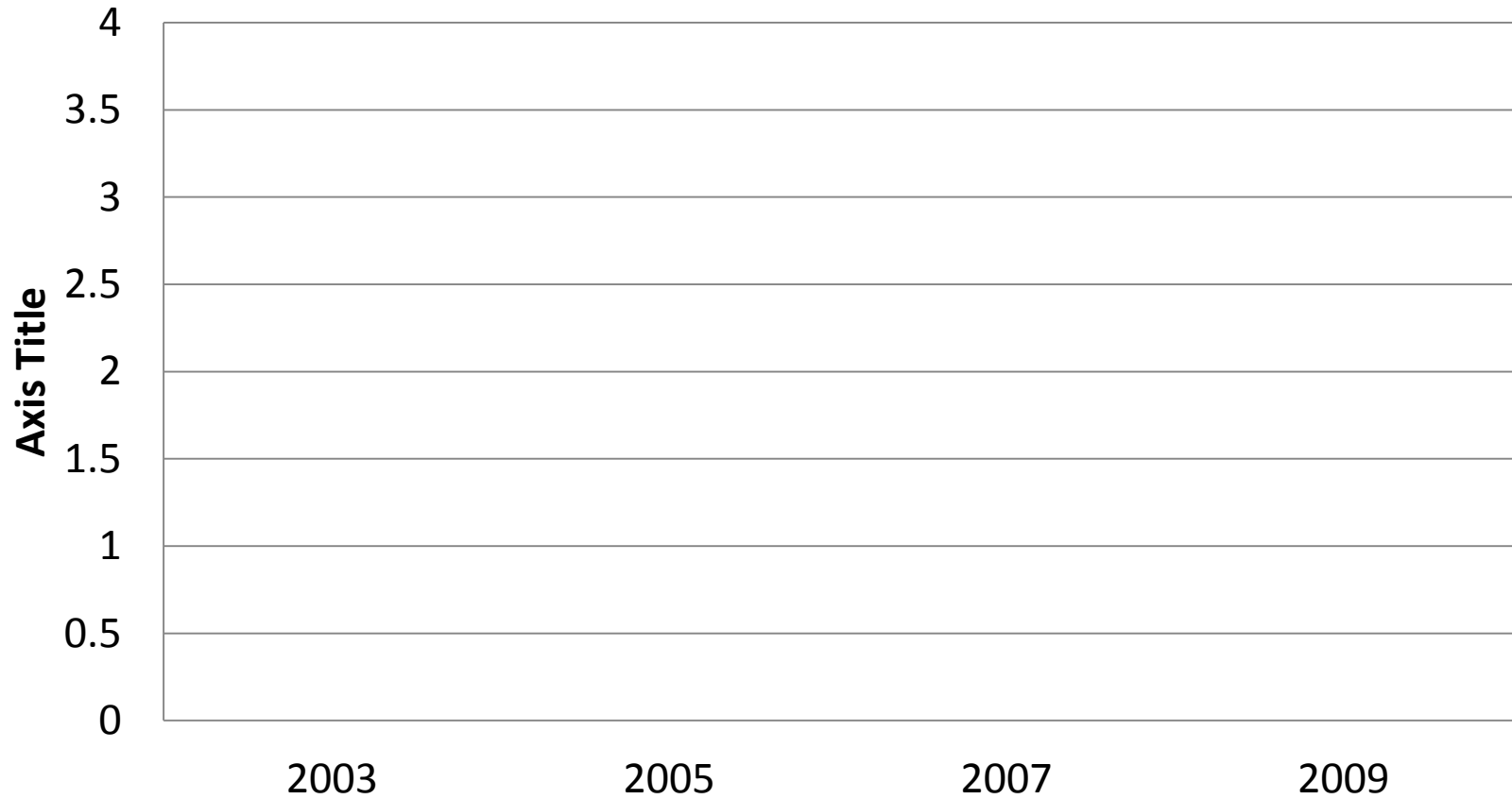
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 2-5 Years



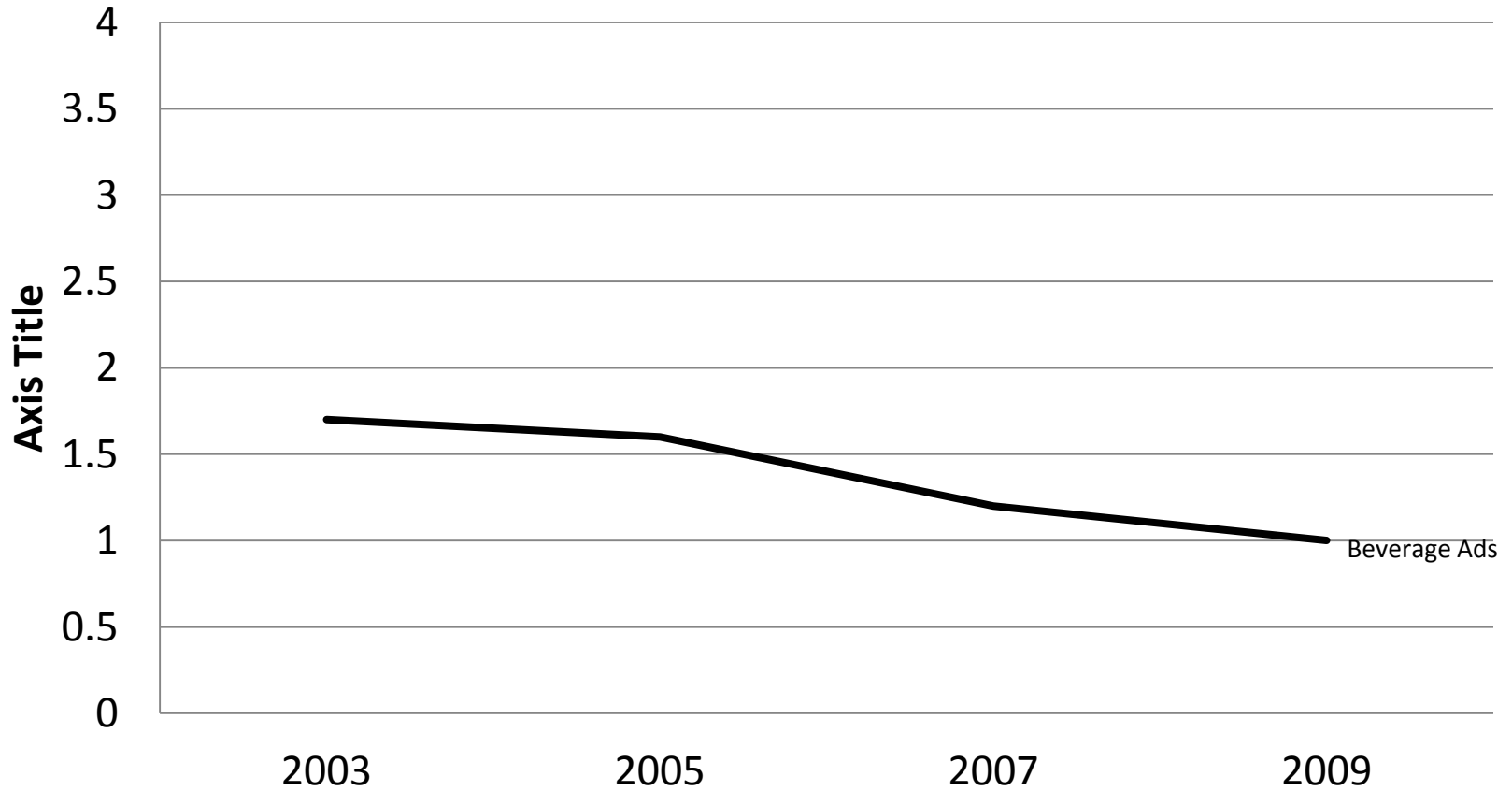
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 6-11 Years



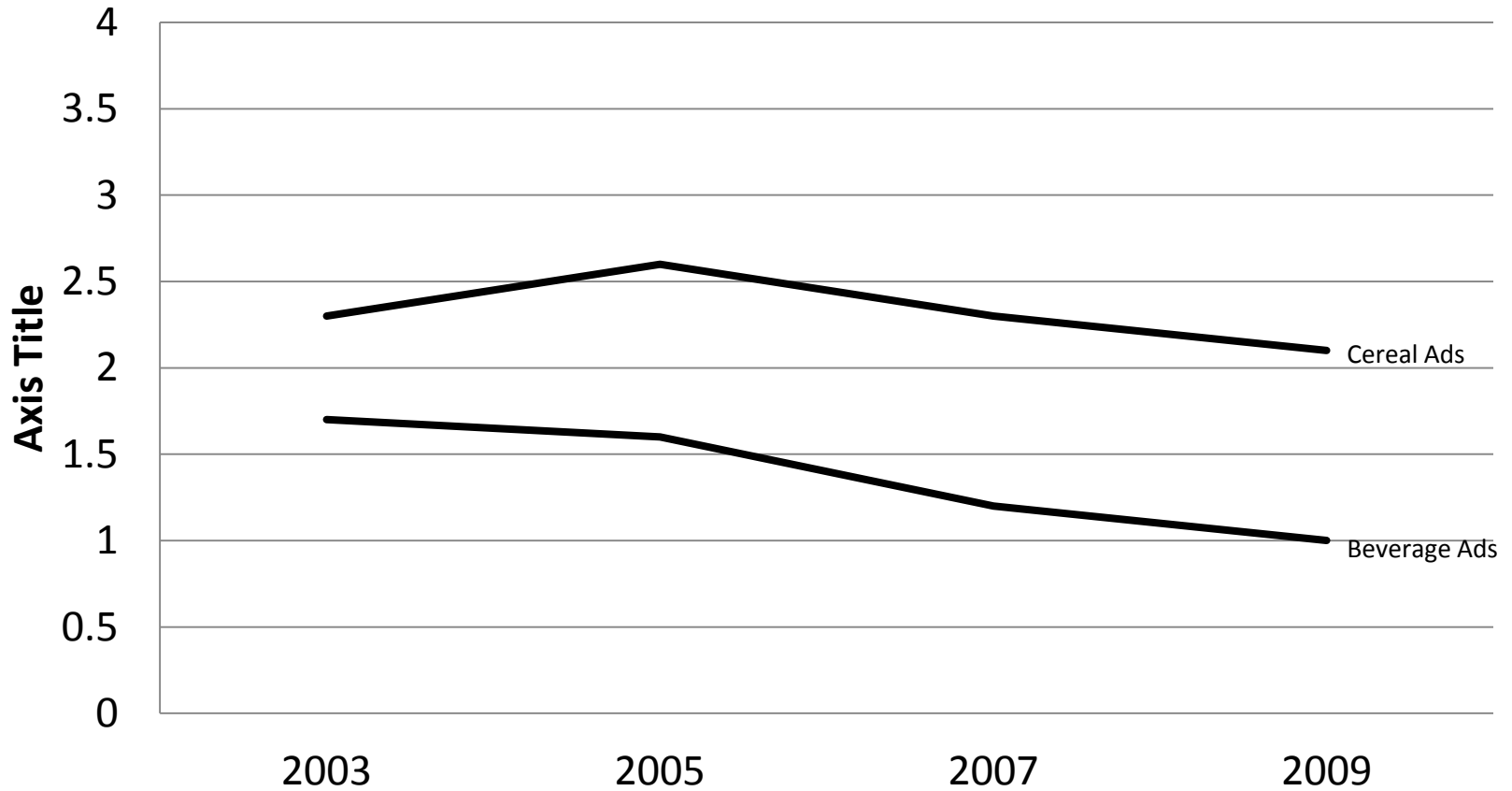
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 6-11 Years



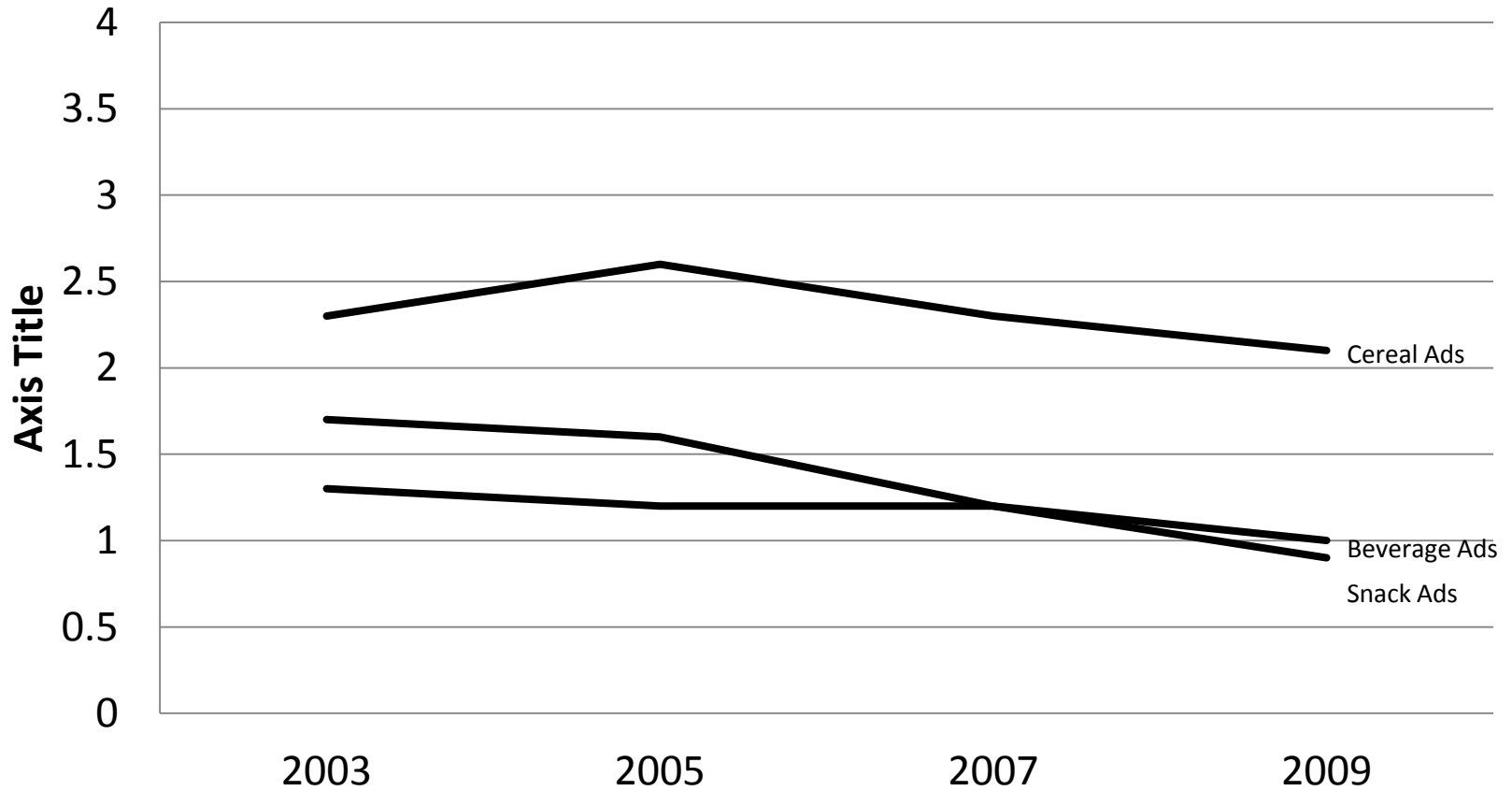
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 6-11 Years



# Exposure to Food Advertisements per Day for Children by Year

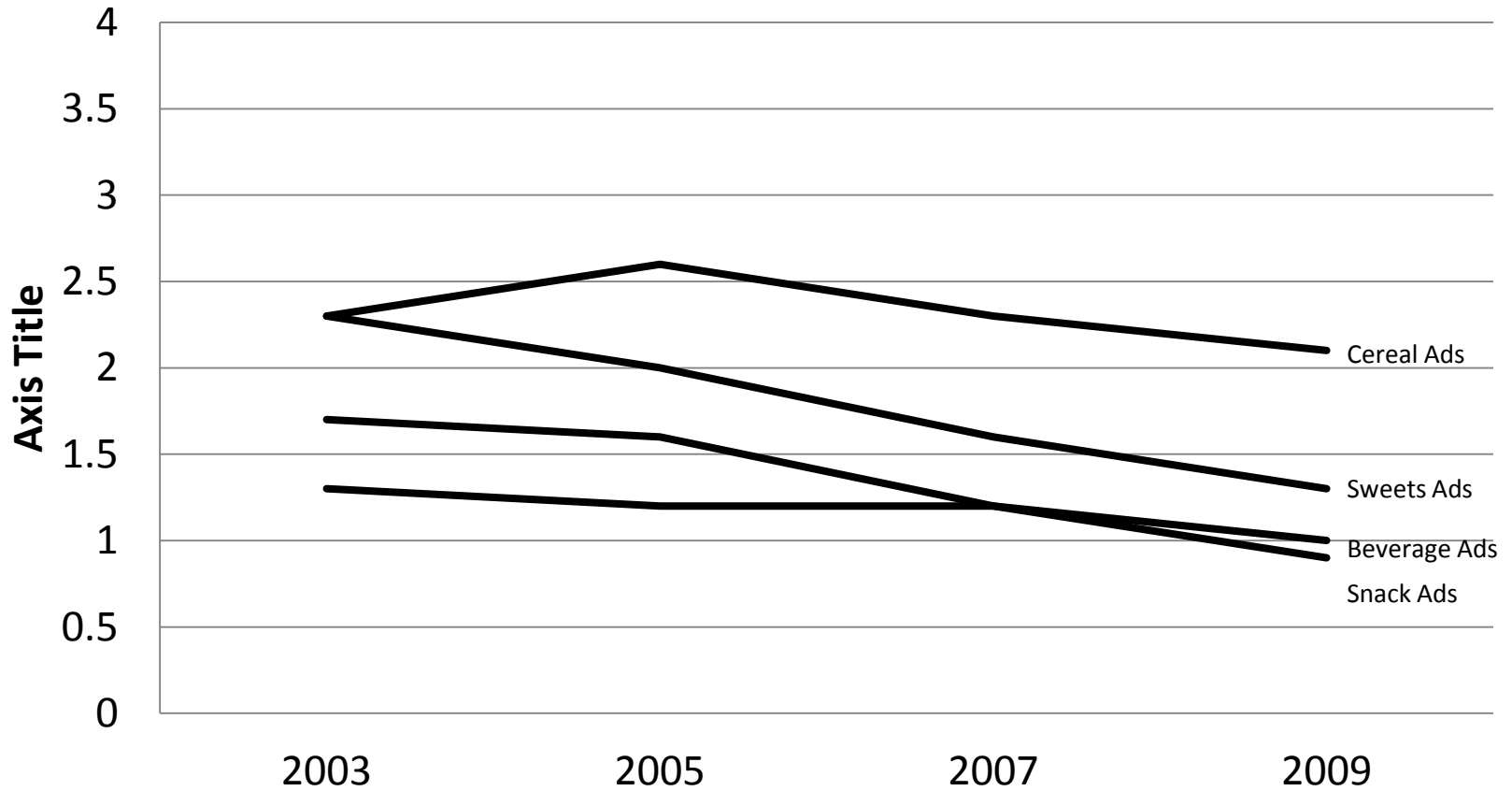
## Children Ages 6-11 Years





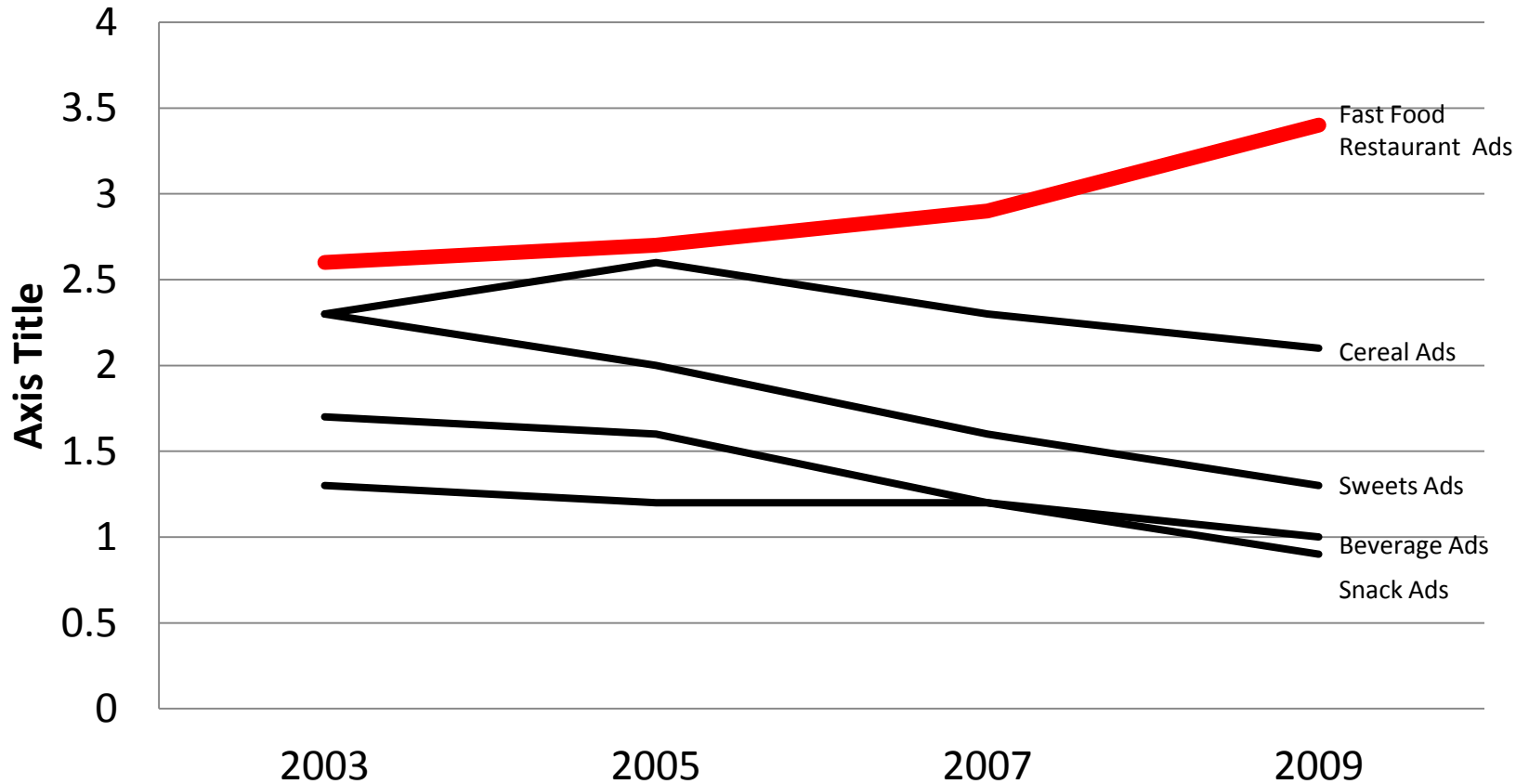
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 6-11 Years



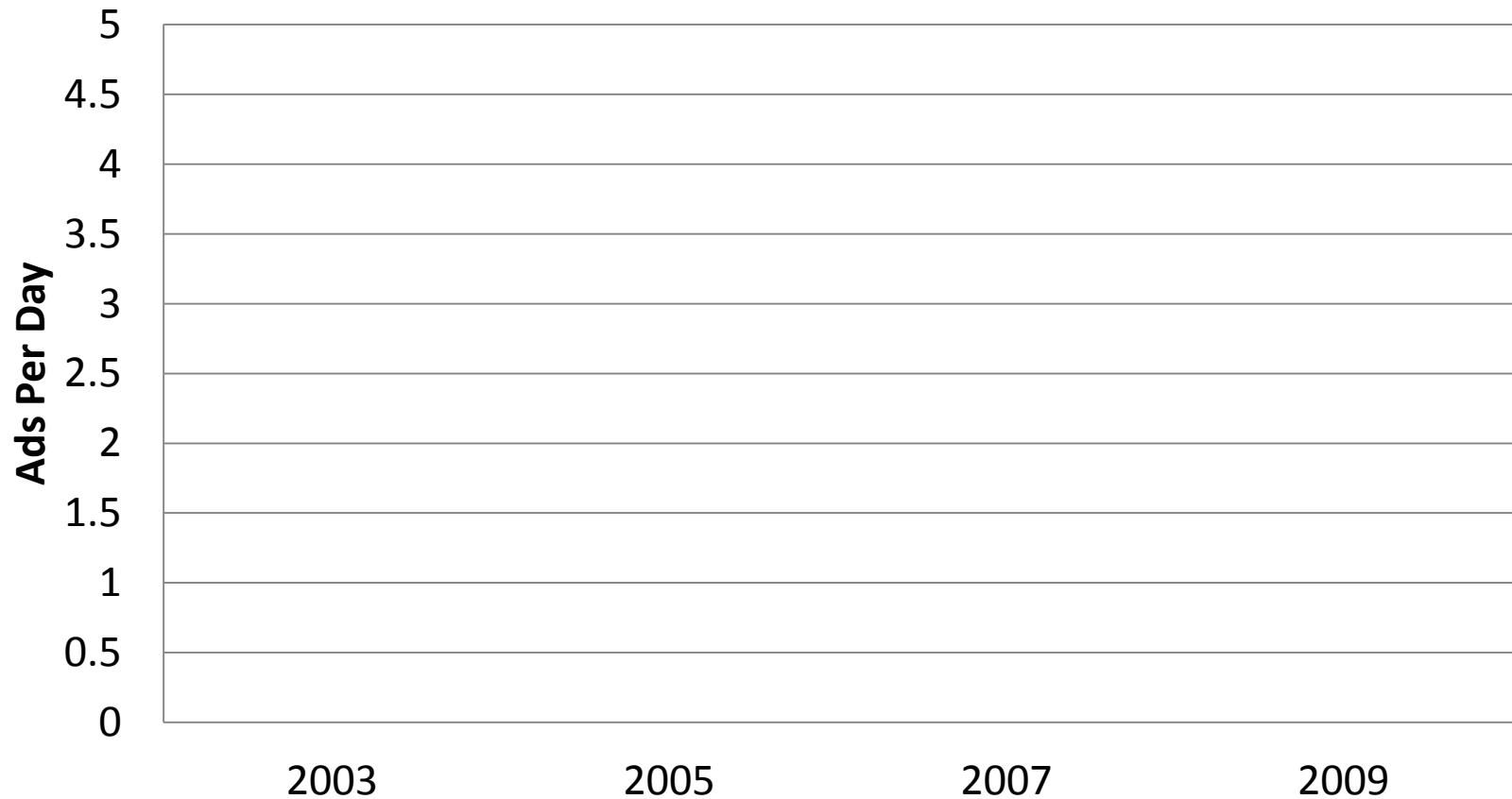
# Exposure to Food Advertisements per Day for Children by Year

## Children Ages 6-11 Years



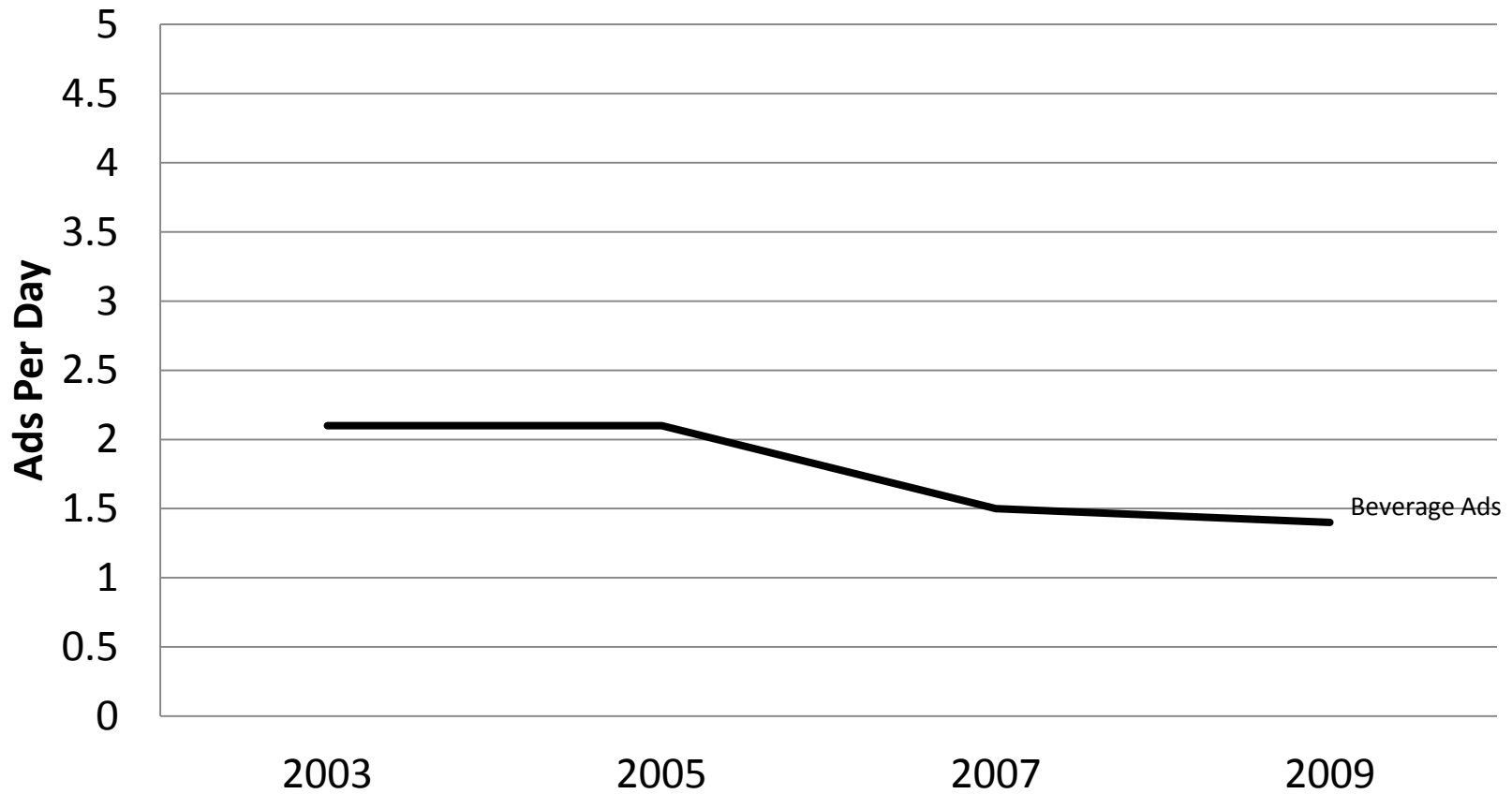
# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years



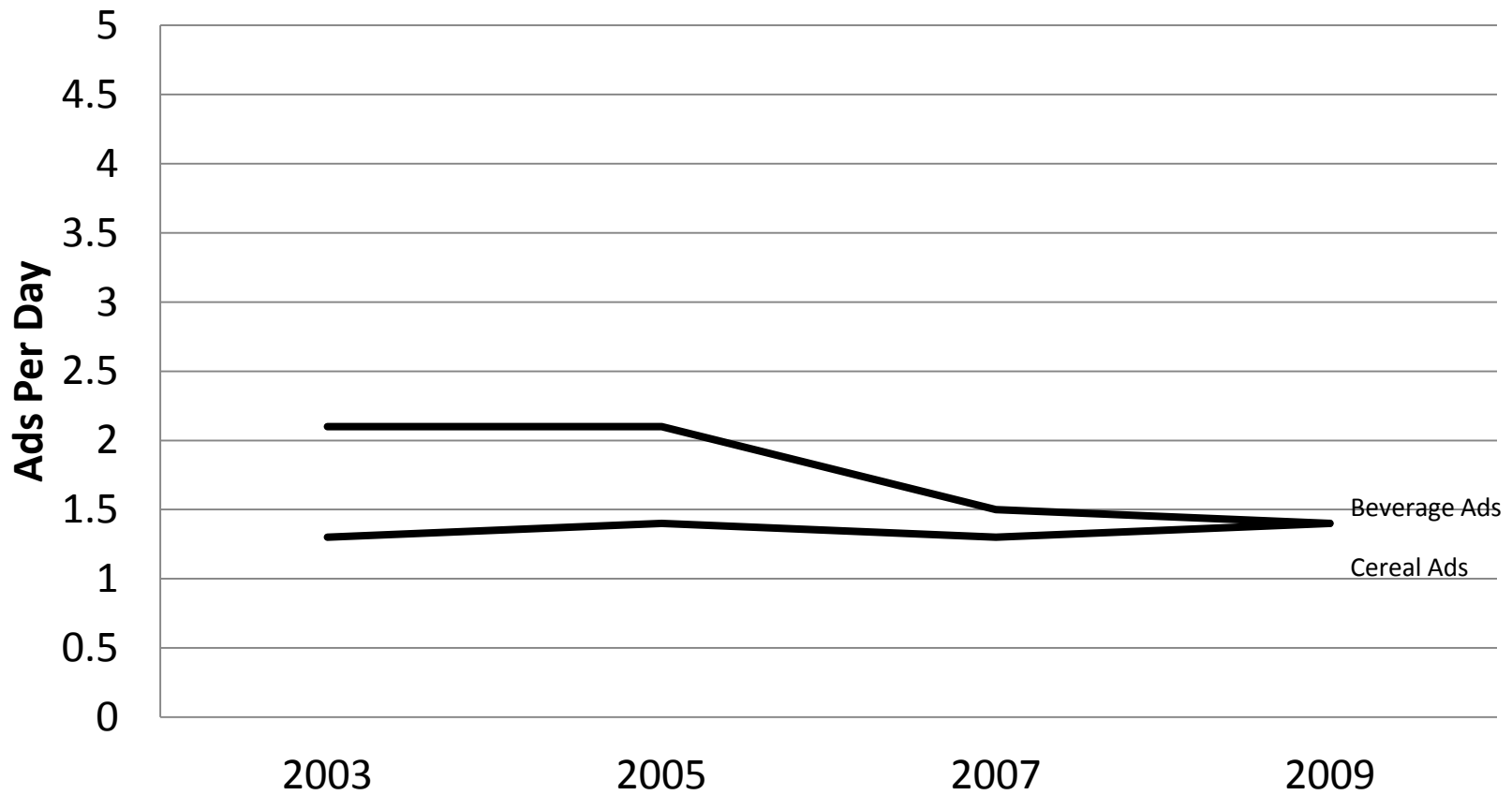
# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years



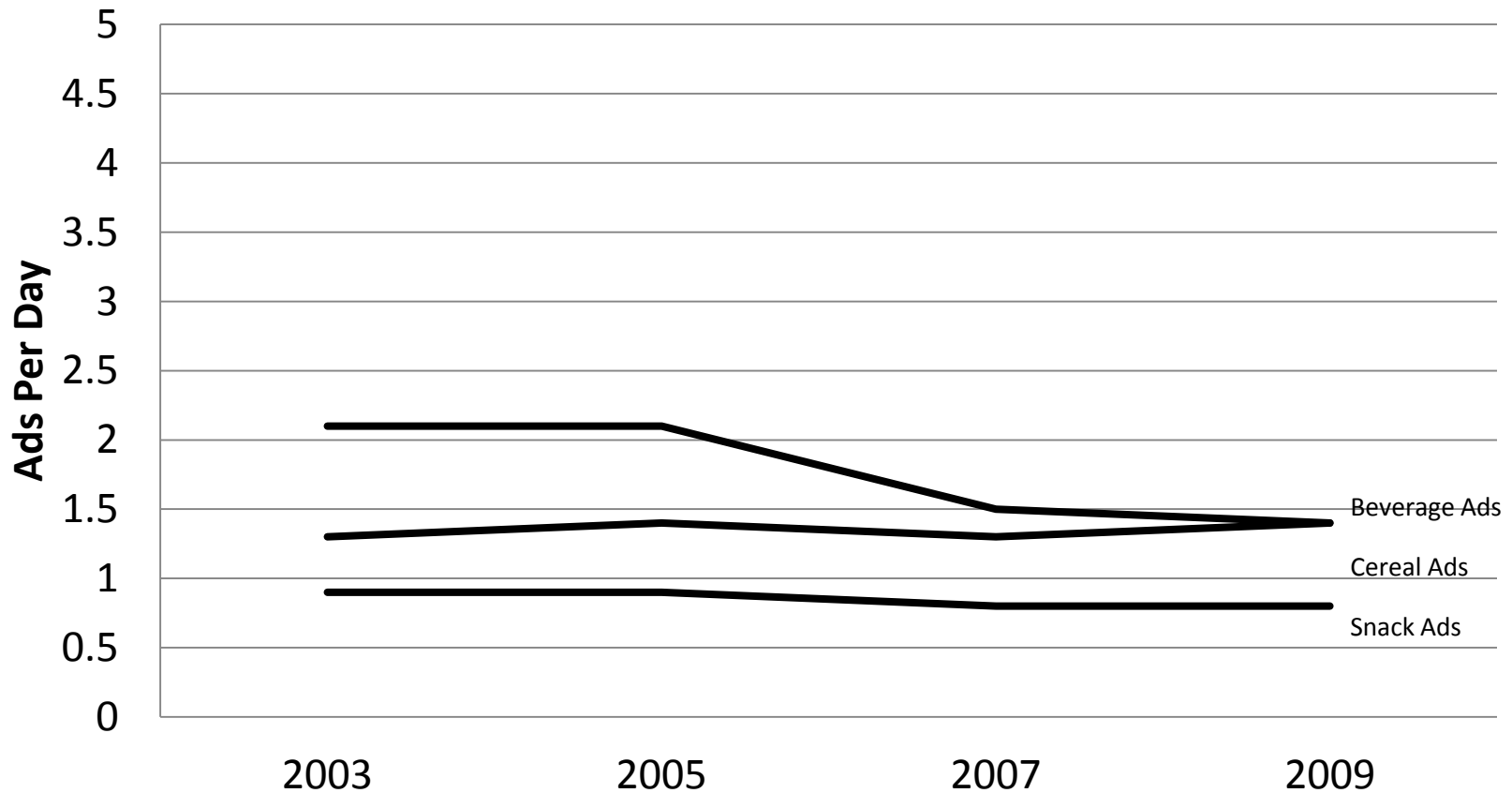
# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years



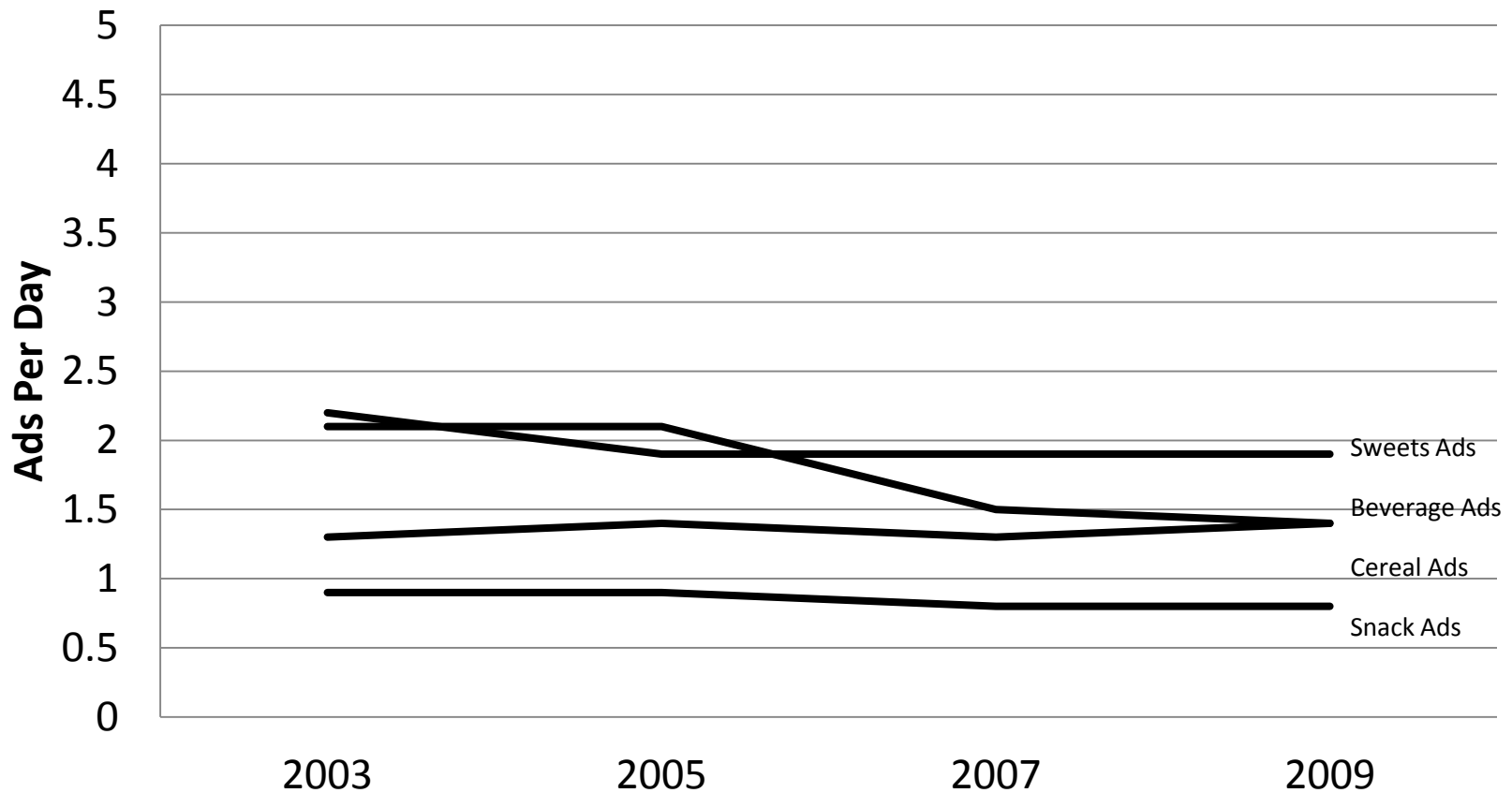
# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years



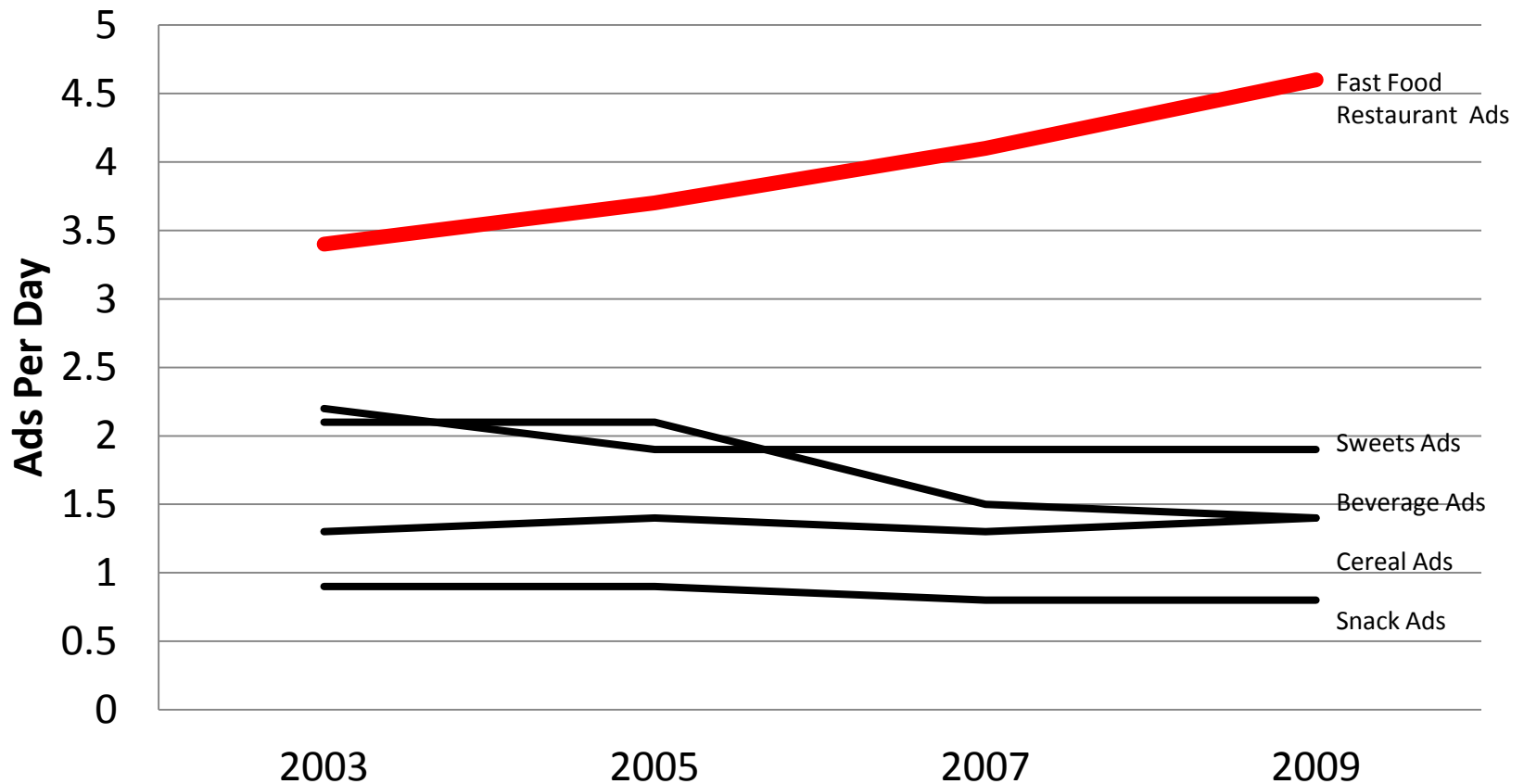
# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years



# Exposure to Food Advertisements per Day for Adolescents by Year

## Adolescents Ages 12-17 Years





# Nutritional Content

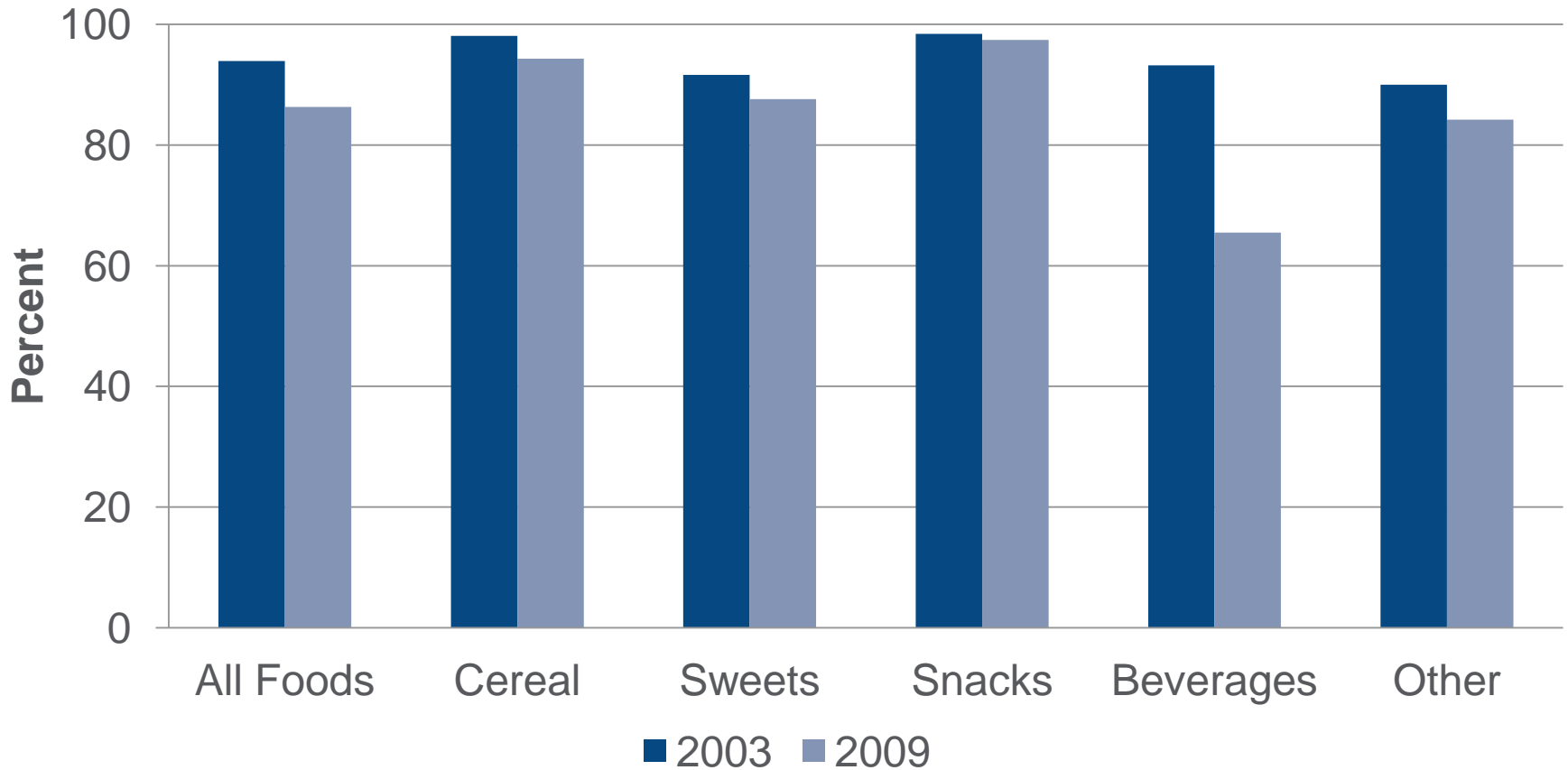
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# Nutritional Content Analysis

- Food and beverage advertisements were assessed on the basis of:
  - **Saturated Fat** (% Kcal): High >10% Kcal from saturated fat
  - **Sugar** (%Kcal): High >25% Kcal from sugar
  - **Sodium** (mg per 50g portion): High >200mg of sodium per 50g portion
  - **Fiber** (g per 50g portion): Low <1.15g of fiber per 50g portion
- Nutritional Content was weighted by the ratings data to provide estimates of exposure to nutritional content

# Food Ads High in Saturated Fat, Sugar or Sodium

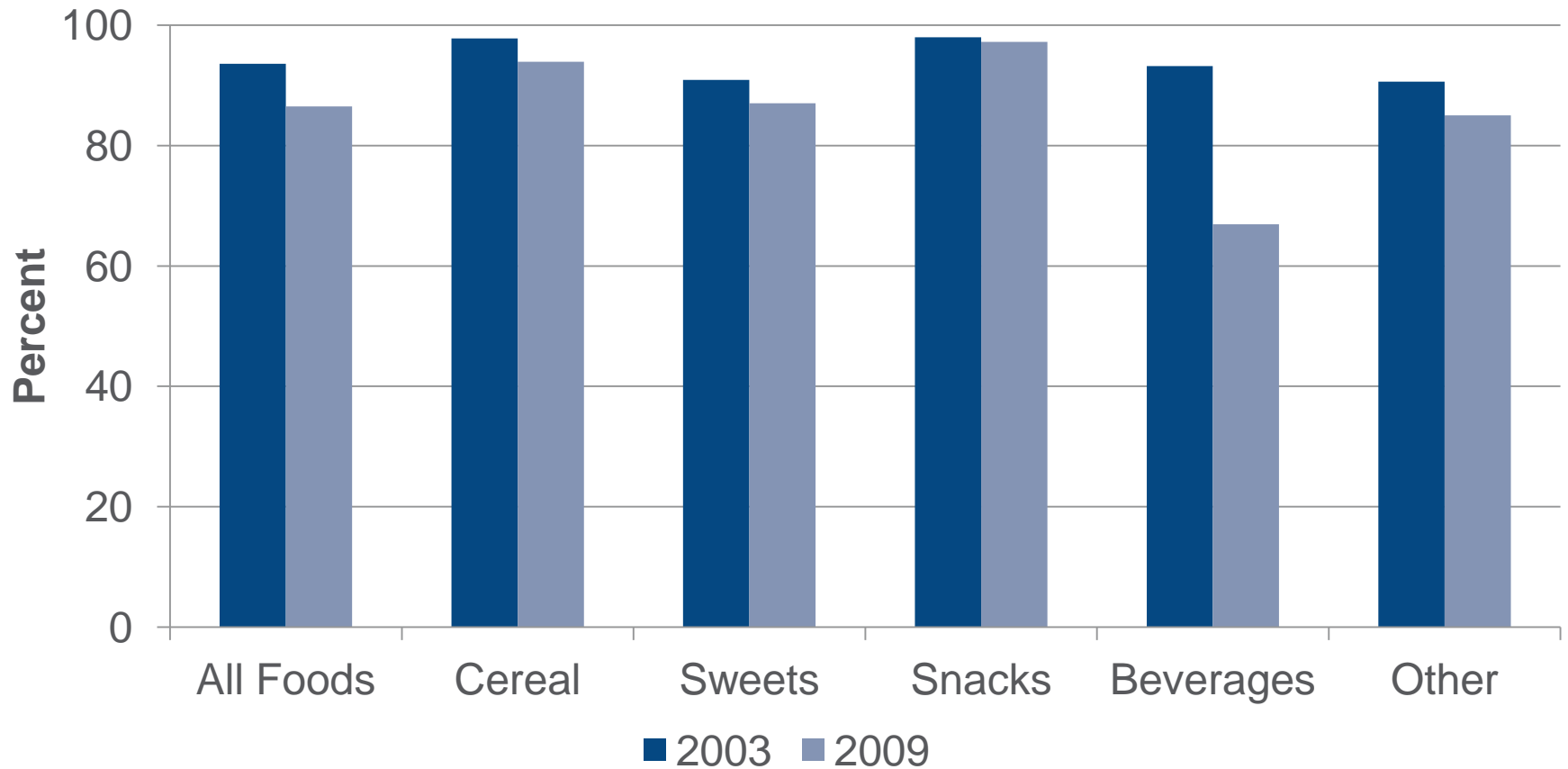
## Children Ages 2-5 Years



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# Food Ads High in Saturated Fat, Sugar or Sodium

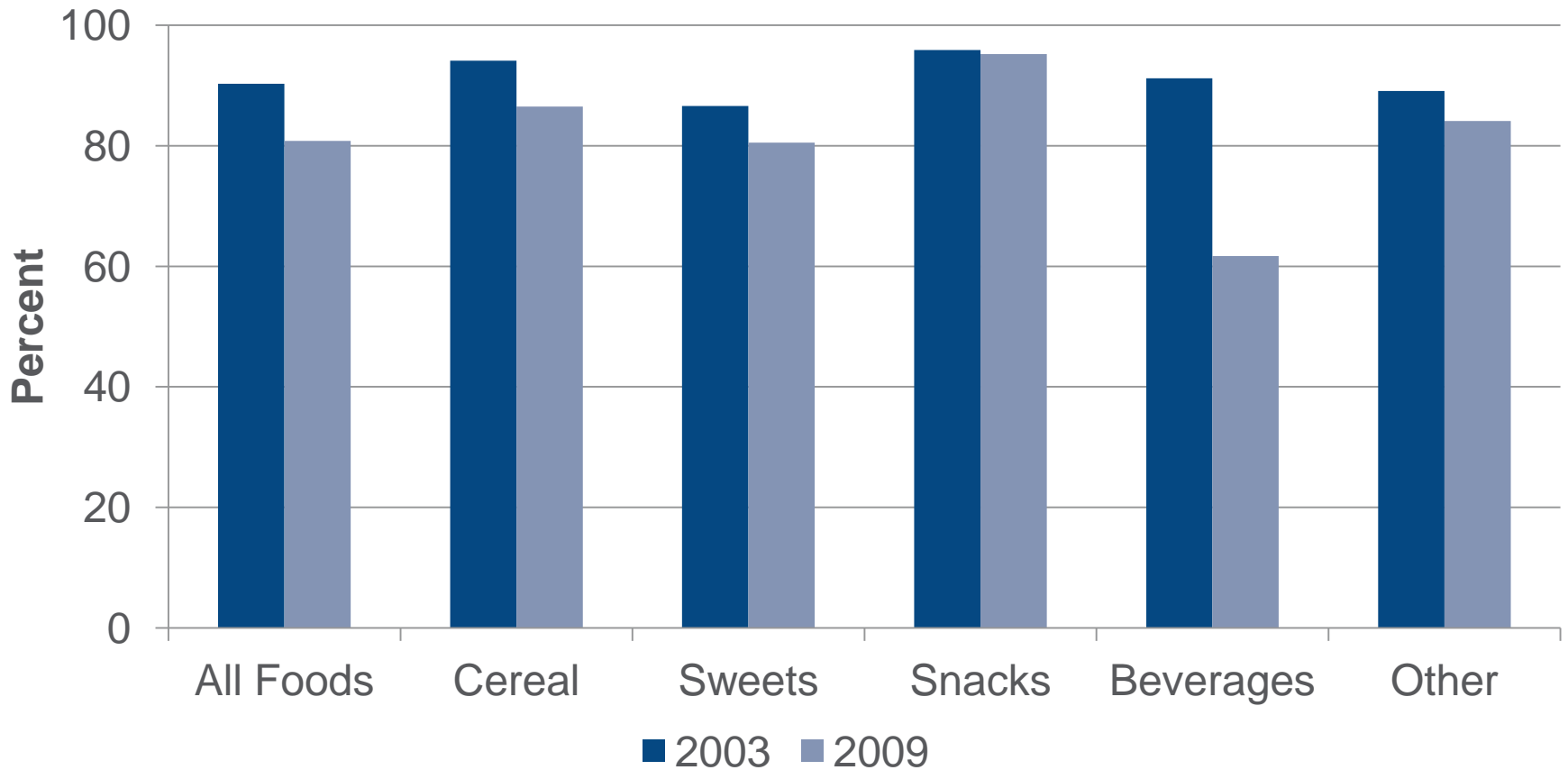
## Children Ages 6-11 Years



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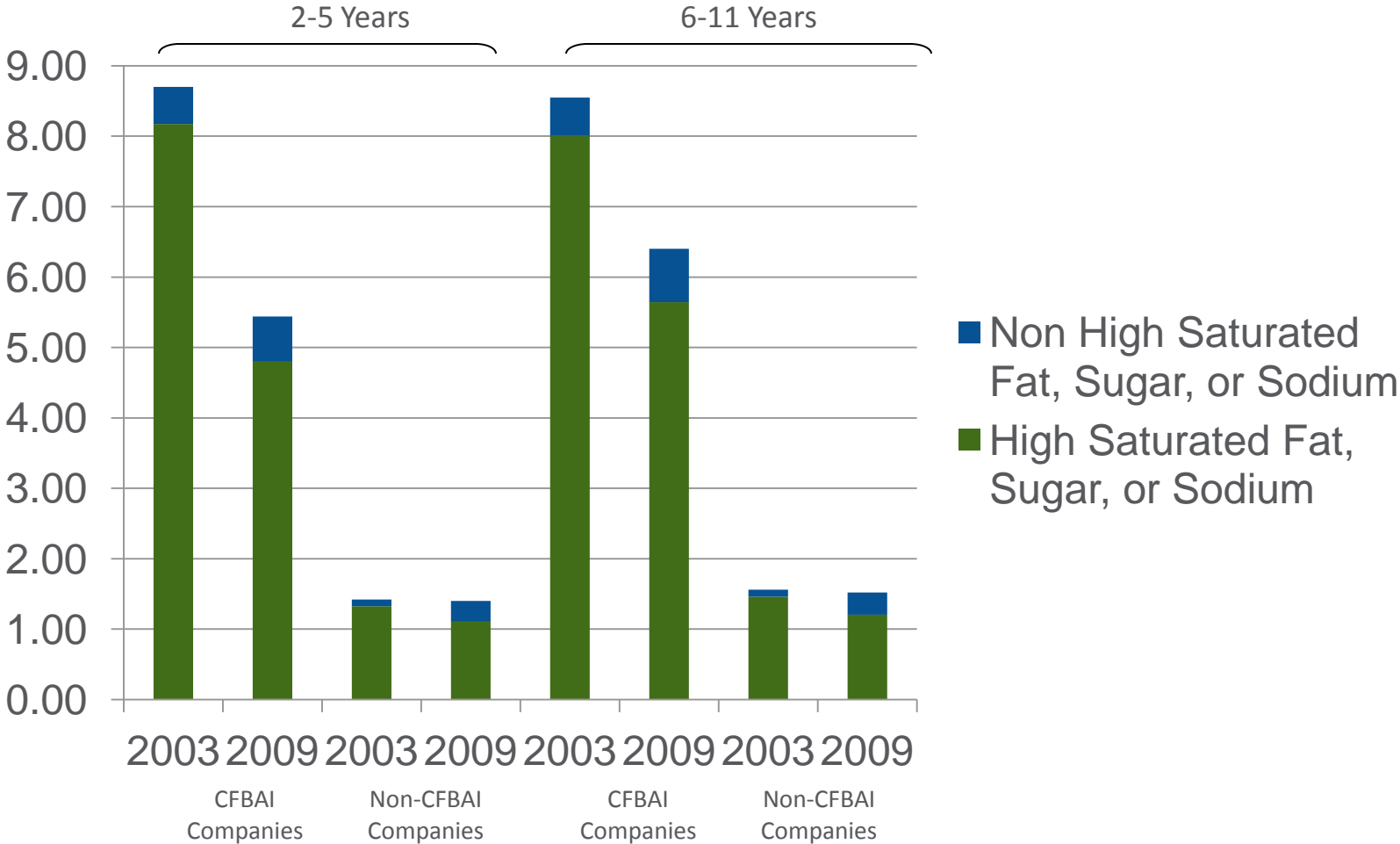
# Food Ads High in Saturated Fat, Sugar or Sodium

Adolescents Ages 12-17 Years



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# Exposure to Food and Beverage Advertisements by High Saturated Fat, Sugar, or Sodium Status, by CFBAI Membership, by Age, and by Year



# Summary and Policy Implications

# Summary: Results of CFBAI Companies

- General Mills remains the largest advertiser; moderate reduction in ads seen by 2-5y (-16%) and an increase for 6-11y (6%). 97% of ads seen are for unhealthy products.
- Kellogg and Kraft ads are both down by about 40-50% for children, but about 9/10 ads still seen are for unhealthy products.
- Coke ads are down substantially (-57%), only company other than Cadbury with less than 50% of ads for unhealthy products.
- Pepsi ads down substantially (-70%), although 82% remain for unhealthy products.
- Increases in sodium offset positive reductions in sat fat and sugar.
- Overall, there were significantly fewer food and beverage product ads seen by children from CFBAI companies (-38%) compared to the 1% reduction in non-CFBAI food companies. But that the vast majority of the CFBAI company ads (**88%**) seen, in 2009, continued to be for products that were high in either saturated fat, sugar or sodium.



# Policy Implications of Trends in Ad Content

- Children, on average, continue to see more than 10 food-related ads on TV every day (teens see almost 15 ads per day)
- Children and teens continue to be exposed mainly to food and beverage ads for products that are high in saturated fat, sugar or sodium
- Study results suggest that industry self-regulation is limited in its effectiveness to substantially improve food-related advertising seen by children on TV
- Key issues of concern for policymakers regarding CFBAI self-regulation:
  - Inadequate nutritional standards
  - IWG agency recommendations
  - No uniform definition of child audiences
  - Does not address reach of ads in non-child programming
  - Does not apply to children age 12 and over
  - Only 2 fast food companies are members of CFBAI

# Complementary Policies

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# Complement Policies Aimed at Reducing Unhealthy Food Consumption with Policies to Encourage Healthy Eating

- Subsidies for fruits and vegetables
  - ❖ Demand Side of the Market through SNAP (or other programs)
  - ❖ Supply Side of the Market through subsidies to suppliers/vendors
- Greater subsidization of healthy school meals
- Other school policies related to standards for competitive foods
- Zoning policies and tax breaks for vendors (potentially targeted to underserved areas; school zones)
- Menu labeling
- Advertising restrictions; Public Service Announcements

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## ImpacTeen

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## Bridging the Gap

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