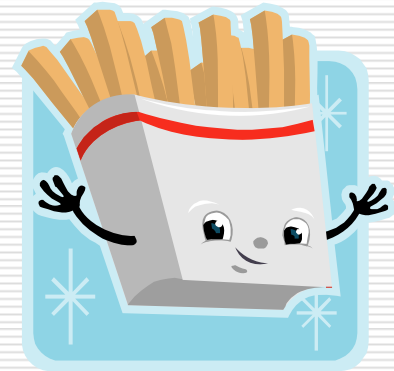


Fast Food Restaurant Advertising on Television and Its Influence on Childhood Obesity

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Severity of Obesity Epidemic

- Majority of Americans are overweight, and 30% are obese, according to most recent NHANES data
 - Associated with increased risk of developing Type II diabetes, coronary heart disease, stroke, high blood pressure, and cancers of the colon, breast and prostate, among other things
 - Economic costs related to overweight and obesity were estimated to be \$99.2 billion as of 1995 (Wolf and Colditz 1998). This figure is now around \$117 billion (\$61 b direct costs; \$56 b indirect).
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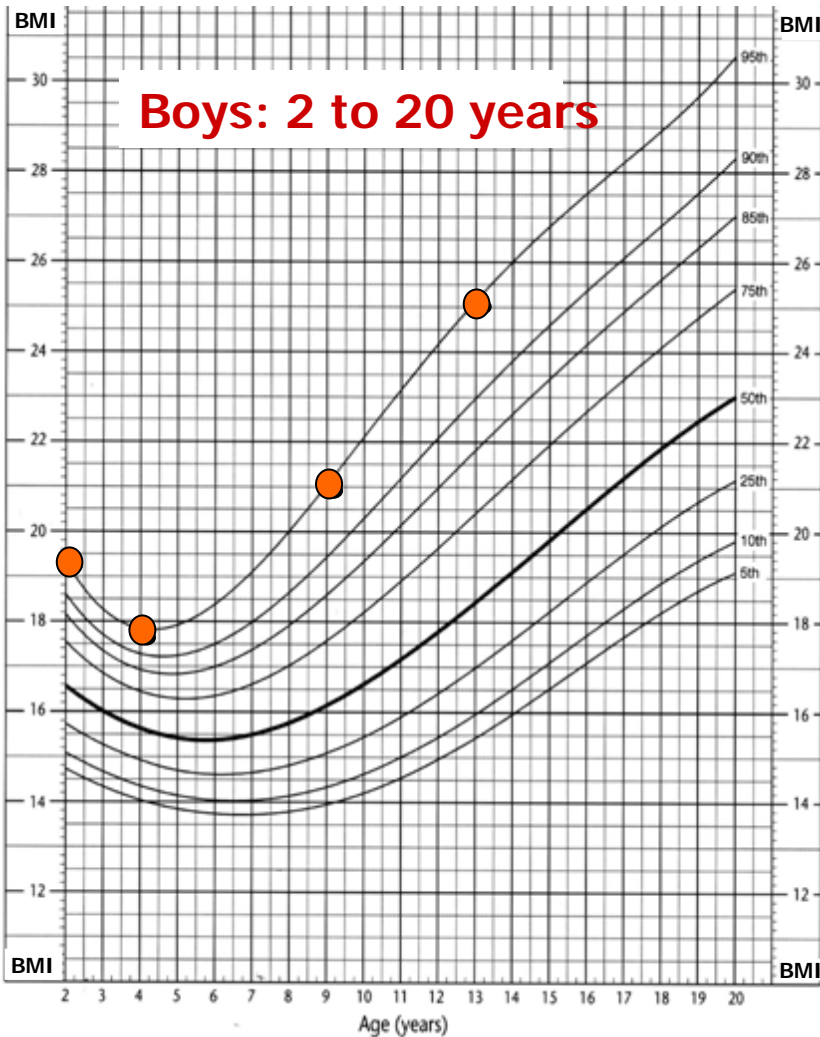
Definition of Obesity

- Obesity is measured using Body Mass Index (BMI)
 - $BMI = (\text{weight in kilograms}) / (\text{height in meters squared})$
 - Overweight adults have a BMI of 25 kg/m² or greater
 - Obese adults have a BMI of 30 kg/m² or greater
 - An overweight, or “at risk of overweight,” child has a BMI at or above the 85th percentile (CDC growth charts)
 - An obese, or “overweight,” child has a BMI at or above the 95th percentile (CDC growth charts)
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Difference between Adults and Children

- Obesity in adults
 - = “Overweight” in children
 - Overweight in adults
 - = “At risk of overweight” in children
-

For Children, BMI Changes with Age



Example: 95th
Percentile
Tracking

Age	BMI
2 yrs	19.3
4 yrs	17.8
9 yrs	21.0
13 yrs	25.1

Children and Adolescents at Risk

- **Overweight children are likely to grow into overweight adults, and lifestyle habits are formed in childhood.**
 - **Severely obese children and adolescents have a lower health-related quality of life.**
 - **According to NHANES, 14% of children aged 2 to 17 are “obese” or overweight (with a BMI at or above 95th percentile).**
-

Trends in BMI and % Overweight, Ages 3-11

Survey	Period	Body Mass Index	Percentage Overweight
NHES II	1963-1965	16.63	4.24
NHANES I	1971-1975	16.44	5.33
NHANES II	1976-1980	16.64	7.33
NHANES III	1988-1994	17.15	10.59
NHANES 99	1999-2000	17.37	14.26

Survey weights are employed in all computations.

Trends in BMI and % Overweight, Ages 12-18

Survey	Period	Body Mass Index	Percentage Overweight
NHES I, III	1959-1962, 1966-1970	20.61	4.45
NHANES I	1971-1975	20.97	6.82
NHANES II	1976-1980	21.03	5.63
NHANES III	1988-1994	22.11	10.62
NHANES 99	1999-2000	22.82	14.75

Survey weights are employed in all computations.

Potential Problems with Use of BMI

- BMI tends to overestimate obesity in athletes with a muscular build
 - BMI tends to underestimate obesity in older people who have lost muscular mass
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Research Goal

- Explore the causal relationship between exposure to television advertising by fast food restaurants and childhood obesity.
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Environment Has Changed

- Technological changes
 - Around 1950, only 2 percent of households in the US had television sets; by the early 1990s, 98 percent of households owned at least one, and over 60% had cable television.
 - Environment not conducive to exercising.
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Previous Studies – Television and Childhood Obesity

Cross-sectional data:

- Positive and significant correlation between obesity prevalence and television viewing (Dietz and Gortmaker, 1985; Gortmaker et al., 1996; Crespo et al., 2001; Anderson et al., 1998)
- No relationship (Robinson et al., 1993).

Randomized controlled trial:

- Support the role of limiting television in prevention of childhood obesity (Robinson, 1999)
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Previous Studies – Television and Childhood Obesity (Continued)

□ Longitudinal Studies:

- Television viewing during childhood and adolescence is associated with overweight in early adulthood (Hancox, 2004).
 - Preschool children who watched the most television had the greatest probability of becoming overweight adolescents (Proctor et al., 2003).
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Previous Studies – TV Advertising and Childhood Obesity

- Middle-school children who watched more TV tended to consume more soft drinks (Giammattei et al., 2003).
 - Children exposed to videotapes with embedded commercials were significantly more likely to choose the advertised items (Borzekowski et al., 2001).
 - Cross-sectional studies cited in Ashton (2004):
 - Quebec
 - Sweden
-

Economic Model

- Becker and Murphy (1993):
 - Advertising and advertised items are complementary goods – consumers may simply derive more utility from consuming a more advertised good.
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Data and Sample

- National Longitudinal Survey of Youth 1997:
 - Adolescents aged 12-18
 - 1997, 1998, 1999

 - National Longitudinal Survey of Youth 1979
 - Children aged 3-11
 - 1996, 1998, 2000
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Data and Sample (Continued)

- Fast Food Restaurant Television Advertising:
 - Competitive Media Reporting, 1996-1999
 - Unit of observation: designated market area
 - Spot television advertising (no network television, syndicated television, and cable network television advertising)
 - Annual number of seconds of fast food restaurant messages aired on television
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Data and Sample (Continued)

- State-level variables:
 - # of fast food restaurants (Census of Retail Trade)
 - # of full service restaurants (Census of Retail Trade)
 - Full service restaurant price (Census of Retail Trade)
 - Fast food restaurant price (ACCRA)
 - Food at home price (ACCRA)
 - Price of cigarettes (Tax Burden on Tobacco)
 - Clean indoor air laws (CDC website)
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Empirical Implementation

$$Y_{ijt} = \gamma_0 + \gamma_1 \ln S_{ijt} + \gamma_2 \ln T_{ijt} + \beta_1 X_{ijt} + \beta_2 M_{ijt} + \beta_3 Z_{ijt} + \mu_j + v_t + \varepsilon_{ijt}$$

- Dependent Variable (Y): BMI & overweight dummy
 - S: advertising exposure
 - T: hours per week spent watching television
 - X: characteristics of children or adolescents
 - M: characteristics of mother
 - Z: state-specific variables
 - μ : DMA fixed effects
 - v : year fixed effects
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Empirical Implementation (Continued)

X includes:

- Age, race dummies (Hispanic, black non-Hispanic, other race), male, dummies for weight and height reported by mothers (NLSY79)

M includes:

- Dummies for mother being overweight and obese, dummy for mother employed, family income, and income missing dummy
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Advertising Exposure Variables

□ Number of hours of spot television fast food restaurant advertising messages seen per week:

■ $S_{ijt} = p_{ijt} \times A_{jt}$

■ $p_{ijt} = T_{ijt} / 168$

Specifications

Specification 1:

- Includes T and S (hours of messages seen)

- T and S are highly correlated

- Television watching and weight reflects causality in both directions

Specification 2:

- Includes S (hours of messages seen) only
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Empirical Implementation

□ Equation can be rewritten as:

$$Y_{ijt} = \gamma_0 - \gamma_1 \ln 168 + \gamma_1 \ln A_{jt} + (\gamma_1 + \gamma_2) \ln T_{ijt} + \beta_1 X_{ijt} + \beta_2 M_{ijt} + \beta_3 Z_{ijt} + \mu_j + \nu_t + \varepsilon_{ijt}$$

Two-Stage Least Squares

- Instrumental Variables:
 - Price of advertisement
 - Number of households with TV
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Table 3
Definitions, Means, and Standard Deviations of Dependent Variables

Variable	Definition	Ages 3–11			Ages 12–18		
		Whole	Male	Female	Whole	Male	Female
Body mass index	Weight (kg) divided by height (m ²)	17.62 (4.67)	17.70 (4.51)	17.53 (4.84)	22.10 (4.44)	22.54 (4.58)	21.65 (4.24)
Overweight	Equals one if BMI is ≥ the 95th percentile	.158 (.365)	.176 (.381)	.140 (.347)	.103 (.304)	.135 (.342)	.070 (.255)
Sample size	Person-year	6,034	3,087	2,947	7,069	3,665	3,404

Note. Data are from the National Longitudinal Survey of Youth 1997. Standard deviations are in parentheses. BMI = body mass index.

Table 4
Definitions, Means, and Standard Deviations of Explanatory Variables

Variable	Definition	Ages 3–11	Ages 12–18
ln(TV Time)	Time spent by child watching television (hours/week; in logs)	2.966 (.788)	2.650 (.805)
ln(Messages aired)	Hours of fast-food restaurant advertising messages aired per week in respondent's DMA (in logs)	1.194 (.361)	1.269 (.383)
ln(Messages seen)	Hours of fast-food restaurant advertising messages seen per week in respondent's DMA (in logs)	-.964 (.861)	-1.205 (.911)
Age	Respondent's age (in years)	7.259 (2.532)	14.769 (1.400)
Hispanic	Equals one if respondent is Hispanic	.060 (.237)	.111 (.315)
Black non-Hispanic	Equals one if respondent is black but not Hispanic	.123 (.329)	.155 (.362)
Other race	Indicates if respondent's race is other than white, black, or Hispanic	. . .	.012 (.111)
Male	Equals one if respondent is male	.513 (.500)	.511 (.500)
Family income	Real household income (1982–84 \$10,000s)	7.062 (10.180)	5.474 (4.193)
Income missing	Equals one if family income is missing	.034 (.180)	.132 (.339)
Weight reported by mother	Equals one if weight is reported by mother	.282 (.450)	. . .
Height reported by mother	Equals one if height is reported by mother	.232 (.422)	. . .
Mother overweight	Equals one if mother's BMI ≥ 25 kg/m ²	.482 (.500)	.493 (.500)
Mother obese	Equals one if mother's BMI ≥ 30 kg/m ²	.218 (.413)	.209 (.407)
Mother employed	Equals one if mother is employed	.693 (.461)	.708 (.455)
Yr98	Equals one if year = 1998	.341 (.474)	.333 (.471)
Yr99	Equals one if year = 1999	. . .	.343 (.475)
Yr00	Equals one if year = 2000	.293 (.455)	. . .
Fast-food restaurants	Fast-food restaurants per 10,000 persons in respondent's state of residence	7.116 (.564)	7.226 (.491)
Full-service restaurants	Full-service restaurants per 10,000 persons in respondent's state of residence	7.144 (.925)	7.232 (1.000)
Cigarette price	Real cigarette price in respondent's state of residence (1982–84 \$)	2.486 (.532)	2.523 (.495)
Government	Equals one if smoking is prohibited in government workplaces in respondent's state of residence	.882 (.323)	.863 (.344)
Private	Equals one if smoking is prohibited in private workplaces in respondent's state of residence	.550 (.498)	.452 (.498)
Restaurant	Equals one if smoking is prohibited in restaurants in respondent's state of residence	.680 (.466)	.654 (.476)
Other	Equals one if smoking is prohibited in other public places in respondent's state of residence	.923 (.266)	.923 (.267)
Full-service restaurant price	Real full-service restaurant meal price in respondent's state of residence (1982–84 \$)	8.991 (1.867)	9.258 (1.975)
Fast-food restaurant price	Real fast-food restaurant meal price in respondent's state of residence (1982–84 \$)	4.529 (.266)	4.558 (.250)
Food-at-home price	Real food-at-home price in respondent's state of residence (1982–84 \$)	2.011 (.230)	2.025 (.266)
N, person-year		6,034	7,069

Note. Data are from the National Longitudinal Survey of Youth 1997. Standard deviations are in parentheses. DMA = designated market area; BMI = body mass index.

Table 5
Regression Results: Dependent Variable Is Body Mass Index

	Specification (1)			Specification (2)		
	Whole	Male	Female	Whole	Male	Female
Ages 3–11:						
ln(Messages aired)	.232 (.763)	.066 (.155)	.544 (1.175)	...	...	...
ln(TV time)	.278** (3.118)	.283* (2.211)	.285** (2.386)	...	...	...
ln(Messages seen)	...	...	...	.276** (3.211)	.272* (2.169)	.297** (2.493)
T-test on equality of coefficient*	.885	.617	.576	...	...	...
R ²	.146	.174	.156	.146	.174	.156
N	6,034	3,087	2,947	6,034	3,087	2,947
Ages 12–18:						
ln(Messages aired)	.266+ (1.630)	.381+ (1.365)	.117 (.557)	...	...	...
ln(TV time)	.474** (4.479)	.556** (4.049)	.380** (3.274)	...	...	...
ln(Messages seen)	...	...	...	.463** (4.721)	.547** (4.280)	.367** (3.367)
T-test on equality of coefficient*	.346	.606	.298	...	...	...
R ²	.193	.191	.236	.193	.191	.236
N	7,069	3,665	3,404	7,069	3,665	3,404

Note. Data are from the National Longitudinal Survey of Youth 1997 (NLSY), and all regressions are weighted by NLSY sampling weights. T-ratios are reported in parentheses. Regressions are clustered by designated market area (DMA). All coefficients are adjusted for individual characteristics, state variables, DMA fixed effects, and year fixed effects. Individual variables include age, black non-Hispanic, Hispanic, other race (NLSY97 only), male, family income, missing income dummy, mother overweight, mother obese, mother employed, and dummies for weight and height reported by mothers (as opposed to actual measurements; NLSY79 only). State variables include the per capita number of fast-food restaurants, per capita number of full-service restaurants, real cigarette price, dummies for clean-indoor-air laws, real full-service restaurant price, real food-at-home price, and real fast-food restaurant price.

*The null hypothesis is that the coefficient of log(messages aired) is equal to the coefficient of log(TV time).

+ Significant at the 10% level (one-tailed test).

* Significant at the 5% level (one-tailed test).

** Significant at the 1% level (one-tailed test).

Table 6
Regression Results: Dependent Variable Is Overweight

	Specification (1)			Specification (2)		
	Whole	Male	Female	Whole	Male	Female
Ages 3–11:						
ln(Messages aired)	.052* (2.302)	.058 ⁺ (1.565)	.049 ⁺ (1.545)	. . .	. . .	. . .
ln(TV time)	.025** (3.319)	.030** (2.560)	.021* (2.111)	. . .	. . .	. . .
ln(Messages seen)	. . .	. . .	. . .	.026** (3.670)	.032** (2.729)	.023* (2.314)
T-test on equality of coefficient ^a	.260	.464	.412	. . .	. . .	. . .
R ²	.088	.102	.102	.088	.102	.102
N	6,034	3,087	2,947	6,034	3,087	2,947
Ages 12–18:						
ln(Messages aired)	.021* (1.967)	.028* (1.846)	.014 (.822)	. . .	. . .	. . .
ln(TV time)	.021** (3.071)	.036** (3.414)	.009 (1.224)	. . .	. . .	. . .
ln(Messages seen)	. . .	. . .	. . .	.021** (3.316)	.036** (3.555)	.009 ⁺ (1.383)
T-test on equality of coefficient ^a	.961	.650	.805	. . .	. . .	. . .
R ²	.100	.108	.127	.100	.108	.127
N	7,069	3,665	3,404	7,069	3,665	3,404

Note. Data are from the National Longitudinal Survey of Youth 1997 (NLSY), and all regressions are weighted by NLSY sampling weights. T-ratios are reported in parentheses. Regressions are clustered by designated market area (DMA). All coefficients are adjusted for individual characteristics, state variables, DMA fixed effects, and year fixed effects. Individual variables include age, black non-Hispanic, Hispanic, other race (NLSY97 only), male, family income, missing income dummy, mother overweight, mother obese, mother employed, and dummies for weight and height reported by mothers (as opposed to actual measurements; NLSY79 only). State variables include the per capita number of fast-food restaurants, per capita number of full-service restaurants, real cigarette price, dummies for clean-indoor-air laws, real full-service restaurant price, real food-at-home price, and real fast-food restaurant price.

^aThe null hypothesis is that the coefficient of log(messages aired) is equal to the coefficient of log(TV time).

⁺ Significant at the 10% level (one-tailed test).

* Significant at the 5% level (one-tailed test).

** Significant at the 1% level (one-tailed test).

Summary

- *Instrumental variables models indicate that OLS models are consistent.*
 - For Children:
 - Advertising has a positive and significant effect on BMI when exposure is measured by hours of messages seen but has no significant impact when exposure is measured by hours of messages aired.
 - Advertising has a positive and significant effect on overweight status.
 - For Adolescents:
 - Advertising has a positive and significant impact on BMI and overweight status.
-

Implications

- Increasing exposure to fast-food advertising by half an hour per week would:
 - Increase percentage of overweight children:
 - By 15% for boys (ages 3-11)
 - By 12% for girls (ages 3-11)
 - Increase percentage of overweight adolescents:
 - By 17% for teenage boys (ages 12-18)
 - By 4% for teenage girls (ages 12-18)
-

Implications

- Imposing a complete advertising ban would:
 - Decrease percentage of overweight children by 18%.
 - Decrease percentage of overweight adolescents by 14%.
 - No Tax Deductibility:
 - Another policy option is to eliminate food advertising as ordinary business expenses that reduce taxable corporate income
 - Since corporate income tax rate is 35%, elimination of tax deductibility would increase the price of advertising by about 54% and:
 - Reduce fast food restaurant messages seen on television by about 40% for children and 33% for adolescents, and thus
 - Reduce number of overweight children by 7%, and adolescents by 5%.
-