CHILD-DIRECTED FOOD MARKETING AND CHILDREN'S INTAKE IN A PROSPECTIVE COHORT STUDY

PRESENTED TO THE NOPREN EC WORKING GROUP
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EARLY CHILDHOOD IS AN IMPORTANT TIME TO SHAPE HEALTHY EATING HABITS…

- Food preferences and eating behaviors develop at a young age
- Kids are eating…
  - Too much sugar
  - Too much fast food
- Nearly one-quarter of all 2-5- year-olds in the US have overweight or obesity
  - Rates have tripled in past 40 years
  - Tracks into adolescence, adulthood

Birch 1998a, Birch 1998b, Birch 1999, Powell 2013, Wikraman 2015, Bowman 2004, Vos 2017, https://www.cnpp.usda.gov/hei-scores-americans, *Ogden 2014, Cunningham 2014, Singh 2008, Freedman 2007*

…BUT WE LIVE IN AN OBESOGENIC FOOD ENVIRONMENT

- Highly palatable, energy-dense foods are readily accessible and highly promoted
  - >$1 billion devoted to child-directed (<12 years of age) food marketing in the US annually
  - Children 2-5 years old on average view 10.4 food ads per day on TV
- Strong evidence that exposure to food marketing shapes young children's food preferences and requests
  - Experimental
  - Cross-sectional studies
  - Ecological studies

Swinburn 2011, Giskes 2011, Birch 2010, Khan 2009, Botha 2012, Harris 2018

FOOD MARKETING AND CHILDREN'S DIET

Gap:

Does child-directed food marketing have a causal effect on children's diet in "the real world"?

Need: Naturalistic, longitudinal studies

Preschoolers' Interests and Choices Study
Hood Center for Children and Families
Geisel School of Medicine at Dartmouth

R01HD071021 (NICHD): Impact of food marketing and cross-promotions on preschoolers' dietary intake.

- Exposure to Child-Directed TV Advertising and Preschoolers' Intake of Advertised Cereals.
  AJPM. 2019. Jennifer A. Emond, ..., Madeline A. Dalton.

- Influence of Child-Targeted Fast Food TV Advertising Exposure on Fast Food Intake: A Longitudinal Study of Preschool-Age Children.
  Appetite. 2019. Jennifer A. Emond, …, Madeline A. Dalton.

- Fast Food Intake and Excess Weight Gain Over a 1-year Period Among Preschool-Age Children.
  Pediatr Obes. 2020. Jennifer A Emond, …,Madeline A Dalton

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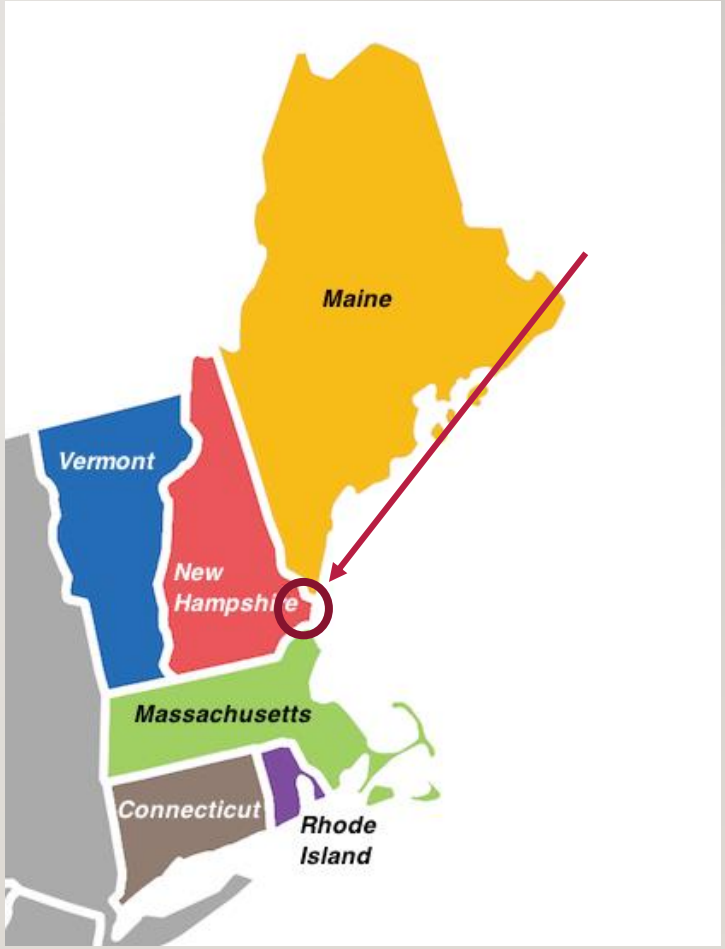
- Fast Food Intake and Excess Weight Gain Over a 1-year Period Among Preschool-Age Children

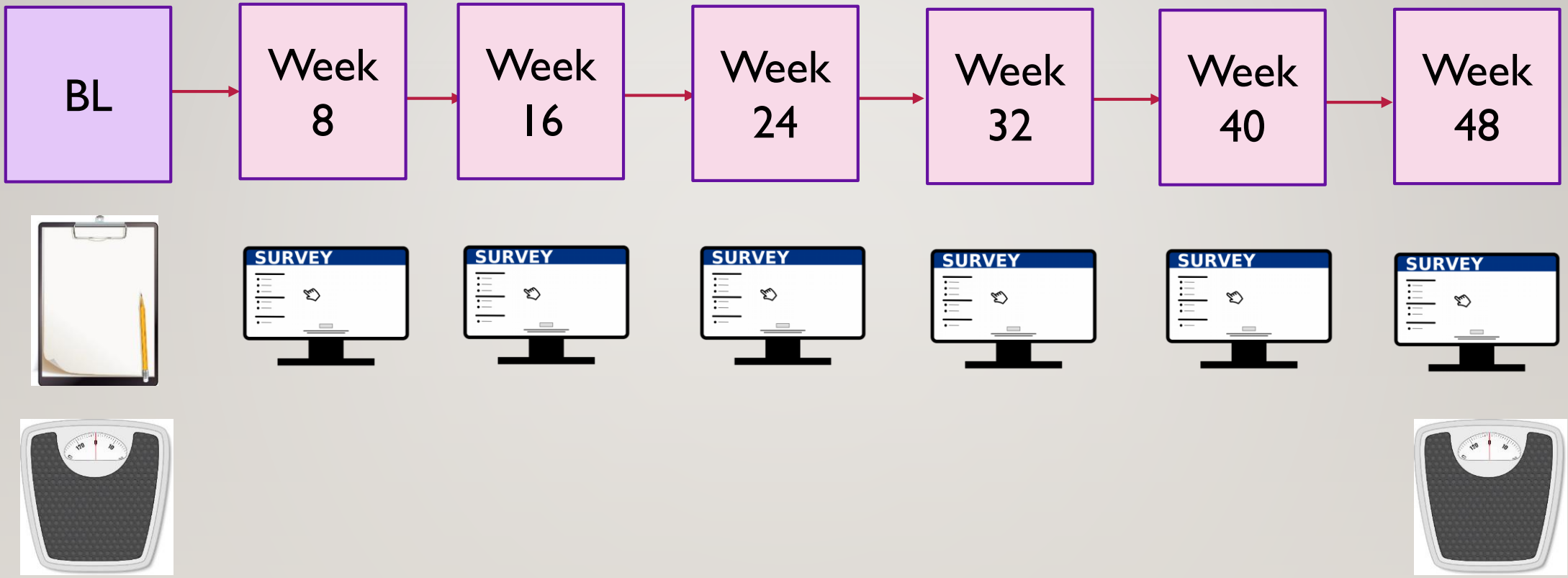
→ The PiCS team also includes Meghan R. Longacre, Keith M. Drake, Linda J. Titus, Kristy Hendricks, Todd MacKenzie, Jennifer L. Harris, Jennifer E. Carroll, Lauren P. Cleveland, Kelly Gaynor, and Gail Langeloh.

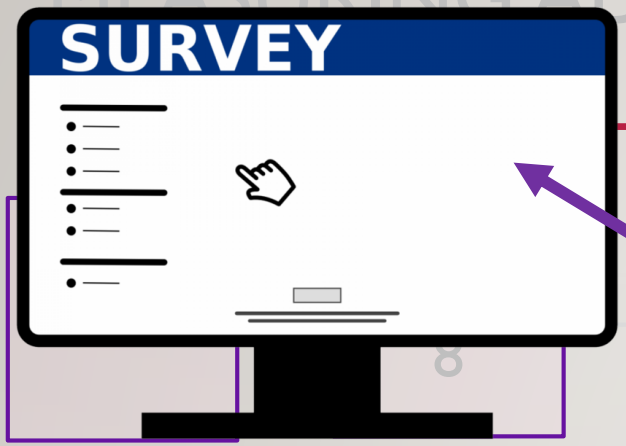
STUDY DESIGN

- Prospective, observational cohort
  - Southern New Hampshire
- 3-5-year-old children and one parent
  - Recruited 2014-2015
- 624 parent child-dyads enrolled
  - 579 (92.8%) of parents completed final survey



MEASURING AD-EXPOSURE AND DIETARY INTAKE





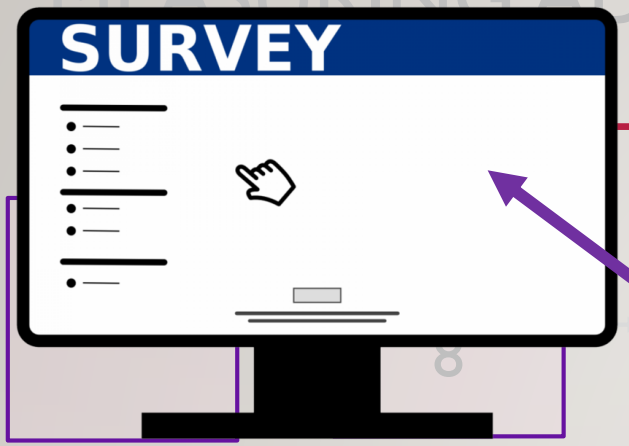
Child's TV Food Ad Exposure in the Past 7 Days

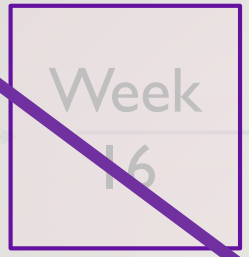
- Did the child watch any of 11 prelisted tv networks
  - 6 were ad-supported
- Specific TV shows on those networks watched
  - Pre-populated list of current TV shows
- Enumerated ads aired on those shows during that timeframe with third-party dataset (Kantar Media)
  - Identified by brand

Ad-supported children's TV networks:

Boomerang
Cartoon Network
Disney XD
Discovery Family Channel
Nickelodeon
NickToons

MEASURING AD-EXPOSURE AND DIETARY INTAKE





Child's Intake in the Past 7 Days

- 14 Breakfast cereals (low to high sugar)
- 11 Popular and regional fast food restaurants

For each item:

0, 1, 2, 3, 4, or 5 or more times per week

BREAKFAST CEREALS

- Exposure and outcome limited to 10 cereals
  - Top-ranked in terms of child-directed TV advertising
  - Sugar content of 9-12 grams of added sugar per 1 ounce (28.3 g) serving
  - 30-41% sugar by weight

<u>10 cereals included</u>
Cinnamon Toast Crunch
Cocoa Pebbles
Cocoa Puffs
Froot Loops
Frosted Flakes
Fruity Pebbles
Honey-Nut Cheerios
Lucky Charms
Reese's Puffs
Trix

(Harris 2012, 2013, 2017)

Sample Characteristics (n=624)

	n (%)
Child characteristics	
Male	279 (44.7 %)
Racial or ethnic minority	92 (14.7%)
WIC Participation	77 (12.3%)
Parent/household characteristics	
Parent educational attainment	
High School or less	151 (24.2%)
Associate's or Technical degree	113 (18.1%)
Bachelor's degree	199 (31.9%)
Graduate degree	161 (25.8%)
Annual household income	
Less than $25,000	80 (12.8%)
$25,001-$75,000	210 (33.7%)
$75,001-$125,000	225 (36.1%)
More than $125,000	109 (17.5%)

Children's usual intake, screen time, ad exposure and weight status at baseline (n=624)

	n (%)
Intake of one of the 10 sugary breakfast cereals	377 (60.4%)
Frequency of getting something to eat or drink at a fast food restaurant	
Never or less than once a month	213 (34.1%)
Once a month but less than once week	239 (38.3%)
At least once a week	172 (27.6%)
Intake of McDonald's	379 (60.7%)
Screen time, hours per week, mean (SD)	
TV (regular, cable or satellite)	8.2 (7.7)
Other screen time	10.1 (12.2)
Usually watches an ad-supported children's network	188 (30.1%)
Weight status	
Healthy weight	447 (71.6%)
Overweight/obese	177 (28.4%)

Not brand-specific

Table 2. SBC advertisement exposure and SBC intake at each follow-up assessment.[a]

Follow-up assessment		Exposure to SBC ads[b]	SBC intake[b] (%)			
	n	%	Overall	Among children **with** SBC ad exposure	Among children **without** SBC ad exposure	*P*-value[c]
1	588	17.2	43.7	55.5	41.3	**0.01**
2	572	19.2	45.3	61.8	41.3	**<0.001**
3	571	18.2	44.8	62.5	40.9	**<0.001**
4	566	18.9	47.0	69.2	41.8	**<0.001**
5	560	19.6	47.3	62.7	43.6	**<0.001**
6	579	26.1	46.8	63.6	40.9	**<0.001**

Note: Boldface indicates statistical significance ($p<0.05$).

SBC: High-sugar breakfast cereal.

[a]Among 624 children enrolled in a prospective study.

[b]Advertisement exposure and SBC intake refers to exposure or intake in the 7 days prior to each follow-up assessment.

[c]*P*-values from chi-square tests.

Exposure to child-directed advertisements for specific sugary breakfast cereals (SBC) is associated with children's intake of those brands:

Brand specific

Model: Poison regression with robust standard errors and cross-nested random effects at participant and SBC brand level

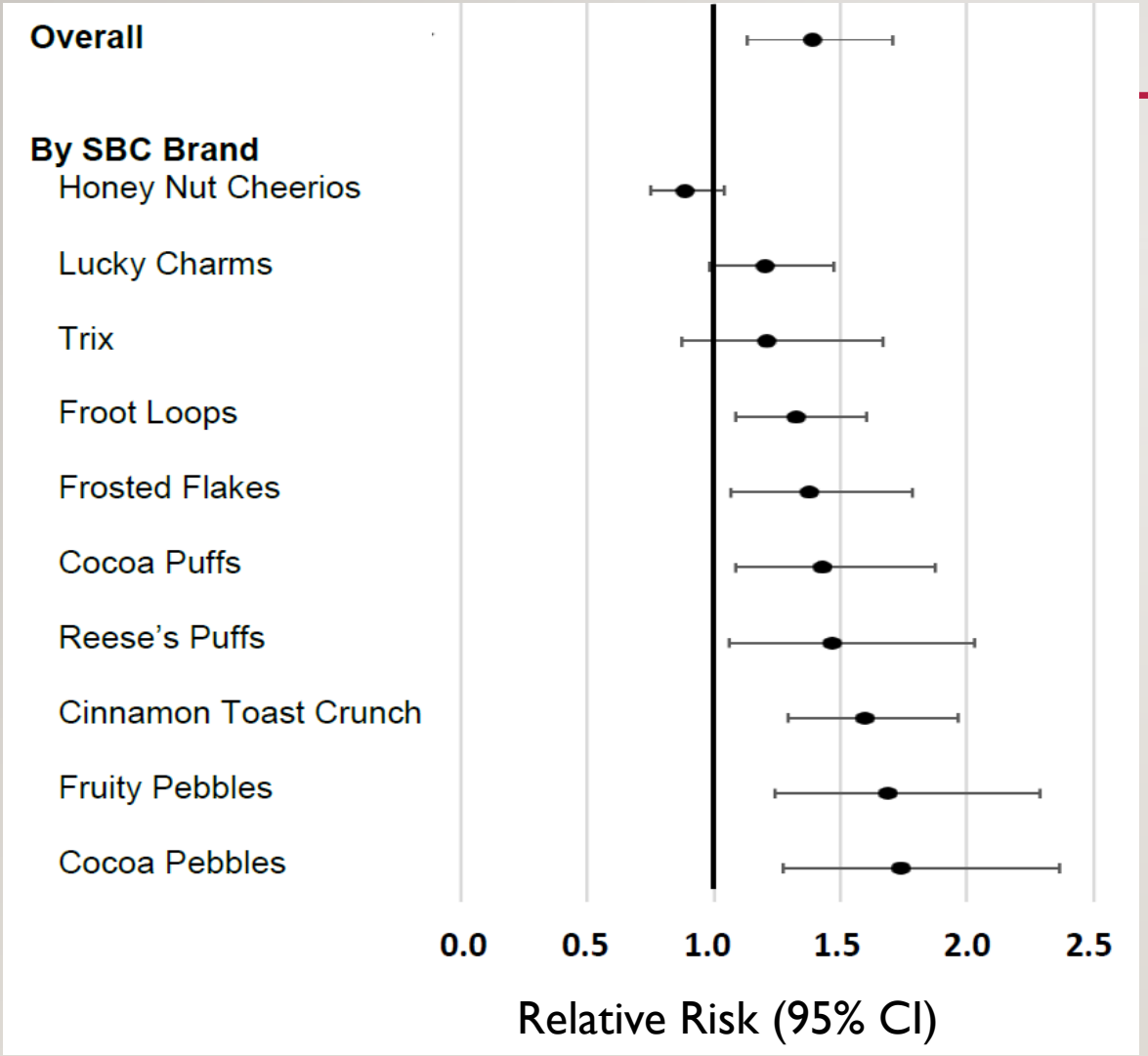
	Outcome: Any SBC intake in past week (yes vs no)
	Adjusted RR (95 % CI)
SBC advertisement exposure, brand-specific	
No exposure	1.00 (Reference)
Recent (i.e., past week) exposure only	1.34 (1.04, 1.72)*
Past exposure only (i.e., at a previous study assessment)	1.23 (1.06, 1.42)*
Recent and any past exposure	1.37 (1.15, 1.63)**
Usual intake of SBC brand at baseline	4.32 (3.92, 4.77)**

*$P<0.05$; **$P<0.001$

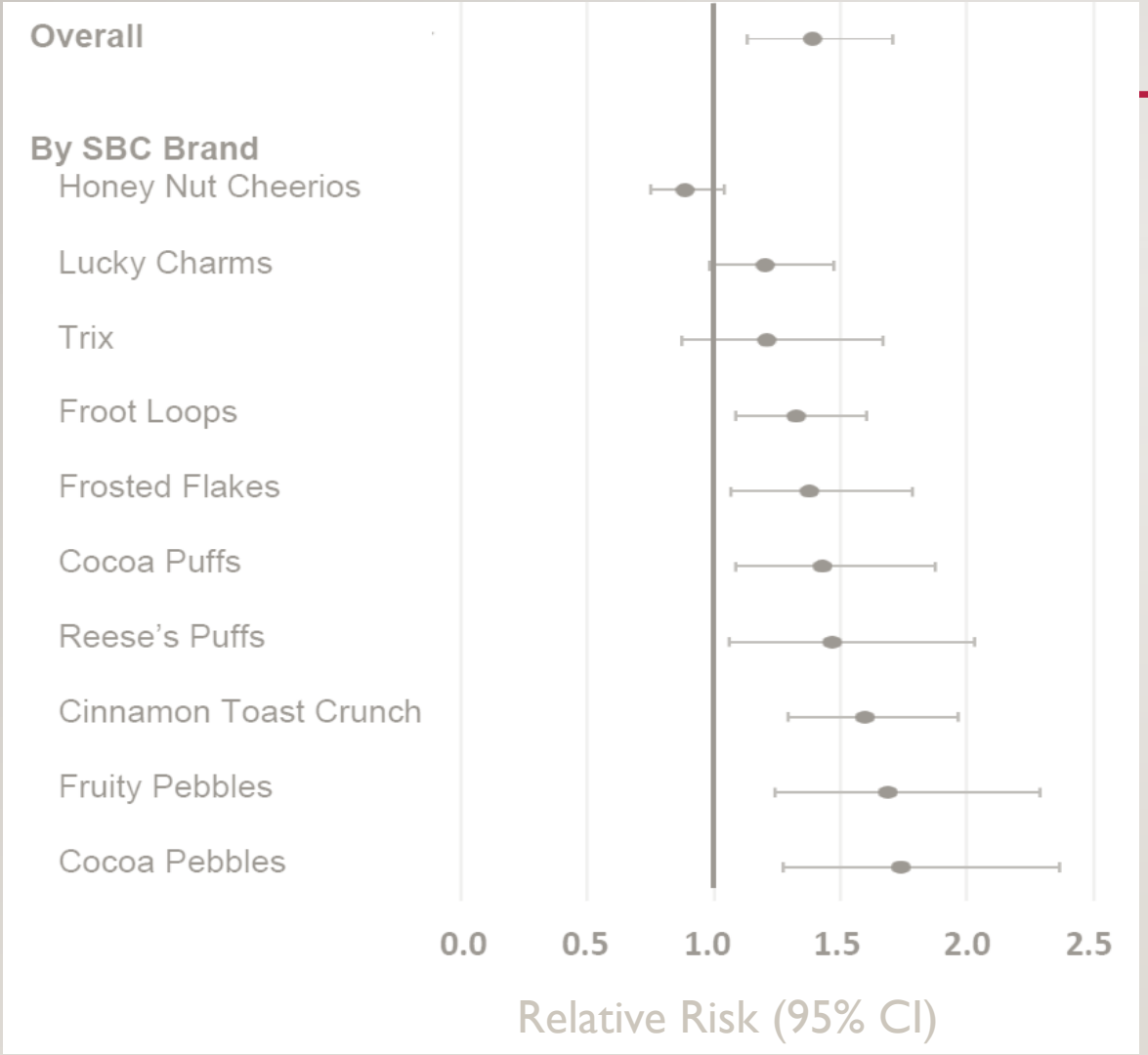
RR: Relative risk. IRR: Incidence rate ratio: SBC: Sweetened (high-sugar) breakfast cereal.

Covariates were child age, gender, race/ethnicity and WIC recipient status; parent education; children's other screen time (hours per week) at baseline and TV time (hours per week) at each study survey.

Adjusted relative risk (left) and absolute risk (right) of sugary breakfast cereal intake ad exposure: Overall and brand-specific



Adjusted relative risk (left) and absolute risk (right) of sugary breakfast cereal intake ad exposure: Overall and brand-specific

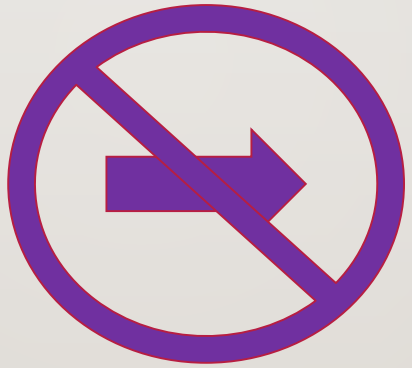


	Predicted probability of intake in past week		
	No ad exposure	Yes ad-exposure	Difference
Overall	6.1%	7.4%	1.3%
By brand:			
Honey Nut Cheerios	20.6%	18.2%	-2.4%
Lucky Charms	9.1%	10.9%	1.9%
Trix	1.5%	1.8%	0.3%
Froot Loops	10.4%	13.8%	3.4%
Frosted Flakes	4.3%	5.9%	1.6%
Cocoa Puffs	3.0%	4.3%	1.3%
Reese's Puffs	1.4%	2.0%	0.6%
Cinnamon Toast Crunch	7.2%	11.4%	4.3%
Fruity Pebbles	1.8%	3.0%	1.2%
Cocoa Pebbles	1.6%	2.8%	1.2%

SBC: Sugary breakfast cereal
Among 624 children enrolled in a prospective study

SPECIFICITY MODEL

- No relationships between exposure to sugary breakfast cereal TV ads and past 7-day intake of Dunkin Donuts when modeled in the same manner.



DUNKIN' DONUTS

SUMMARY

- We observed brand-specific associations between exposure to TV advertisements for sugary breakfast cereal and children's intake of those ***specific brands*** of cereal.

- Effect sizes were ***small***, yet robust across models and with adjustments for important covariates, including children's usual intake of each cereal at baseline.

FAST FOOD TV ADVERTISING

- Three fast food restaurants aired child-directed TV ads during the study period (2014-2017)
  - On the six, child-directed TV networks
- Few children exposed to ads from Wendy's or Subway at any follow-up: 5.5% and 8.5%, respectively.
- Final analysis limited to McDonald's

MODELING APPROACH

- Outcomes
  - Any McDonald's Intake in past 7 days (yes/no)
  - # Times consumed in past 7 days
- Mixed-effects Poisson regression with robust standard errors
  - Models adjusted for baseline intake, covariates and time
- McDonald's ad exposure modeled as "adstock"
  - Simple decay model
  - Cumulative exposure since baseline with decay rate of 8% per week
  - Classified as no exposure versus tertiles of exposure

Adstock: Clarke 1976, Broadbent 1976, Broadbent 2000

EFFECT MODIFICATION

- Models were fit overall and stratified by parent frequency of fast food intake at baseline*
  - Infrequently (<monthly): n=195 (31.3%)
  - Frequently (≥monthly): n=429 (68.8%)

**This categorization resulted in the best model fit.*

https://www.mcdonalds.com/us/en-us/moments.html

Birch 1980, Birch 2014, Patrick 2005, Savage 2007, Dalton 2017, Sonneville 2012

RESULTS

Table 1. Baseline sample characteristics, and associations between each characteristic and children's McDonald's intake over the study period.

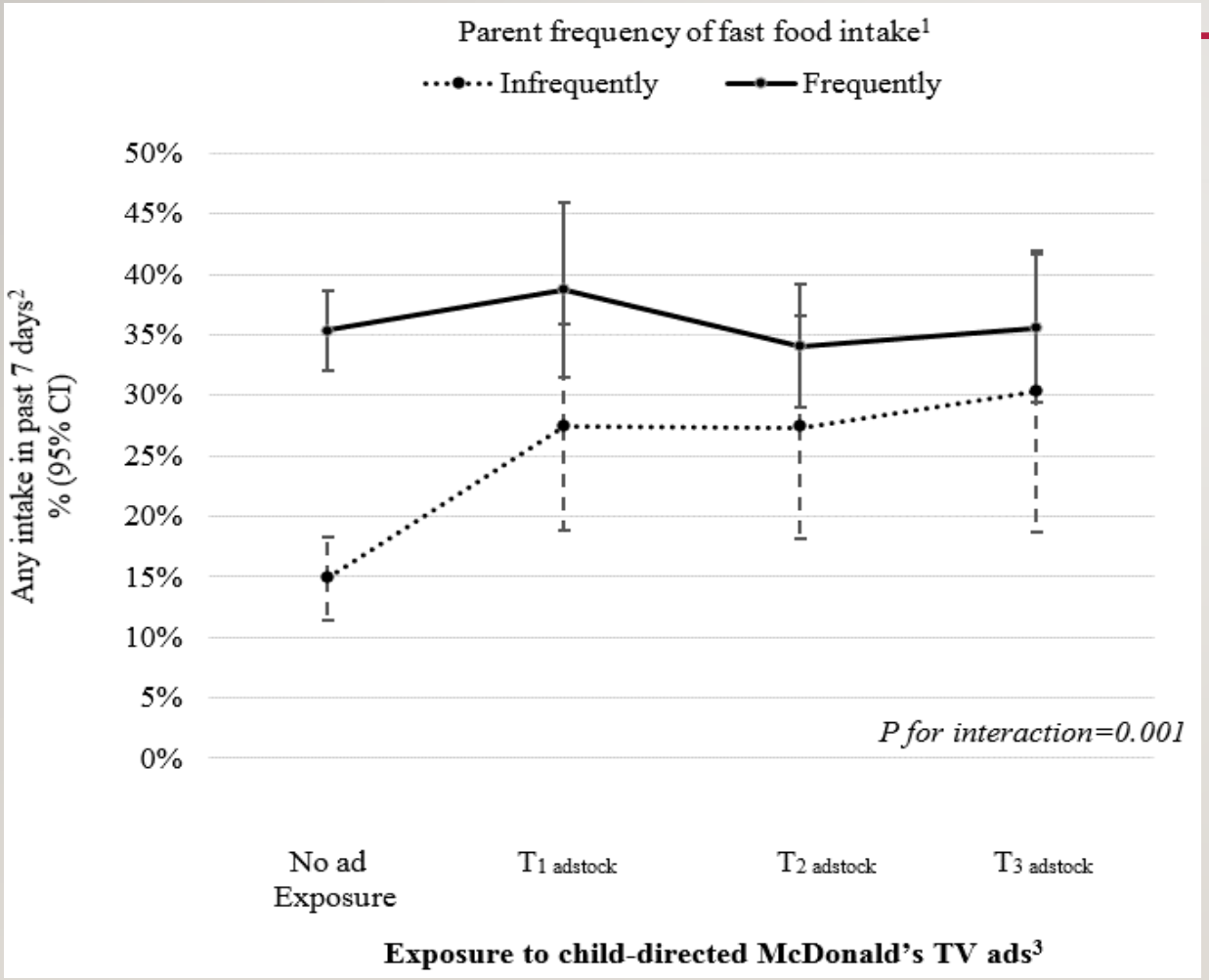
	n	%	Any McDonald's intake RR (95% CI)
Consumes McDonald's	379	60.7	3.73 (2.93, 4.76)†
Parent fast food intake frequency[3]			
Infrequently (< monthly)	195	31.3%	1.00 (Reference)
Frequently (at least monthly)	429	68.8%	2.10 (1.67, 2.62)†

Adjusted associations between children's exposure to child-directed McDonald's TV advertisements and any intake of McDonald's throughout the study.

	Any McDonald's intake (yes vs. no), RR (95% CI)			
		Child McDonald's TV ad exposure[c]		
	No ad exposure	Lowest (tertile 1 of adstock)	Mid (tertile 2 of adstock)	Highest (tertile 3 of adstock)
% of Participants (mean)	65.9%	11.3%	11.3%	11.6%
All participants (n=624)	1.00 (Reference)	1.20 (1.00, 1.44)*	1.08 (0.92, 1.27)	1.14 (0.95, 1.36)

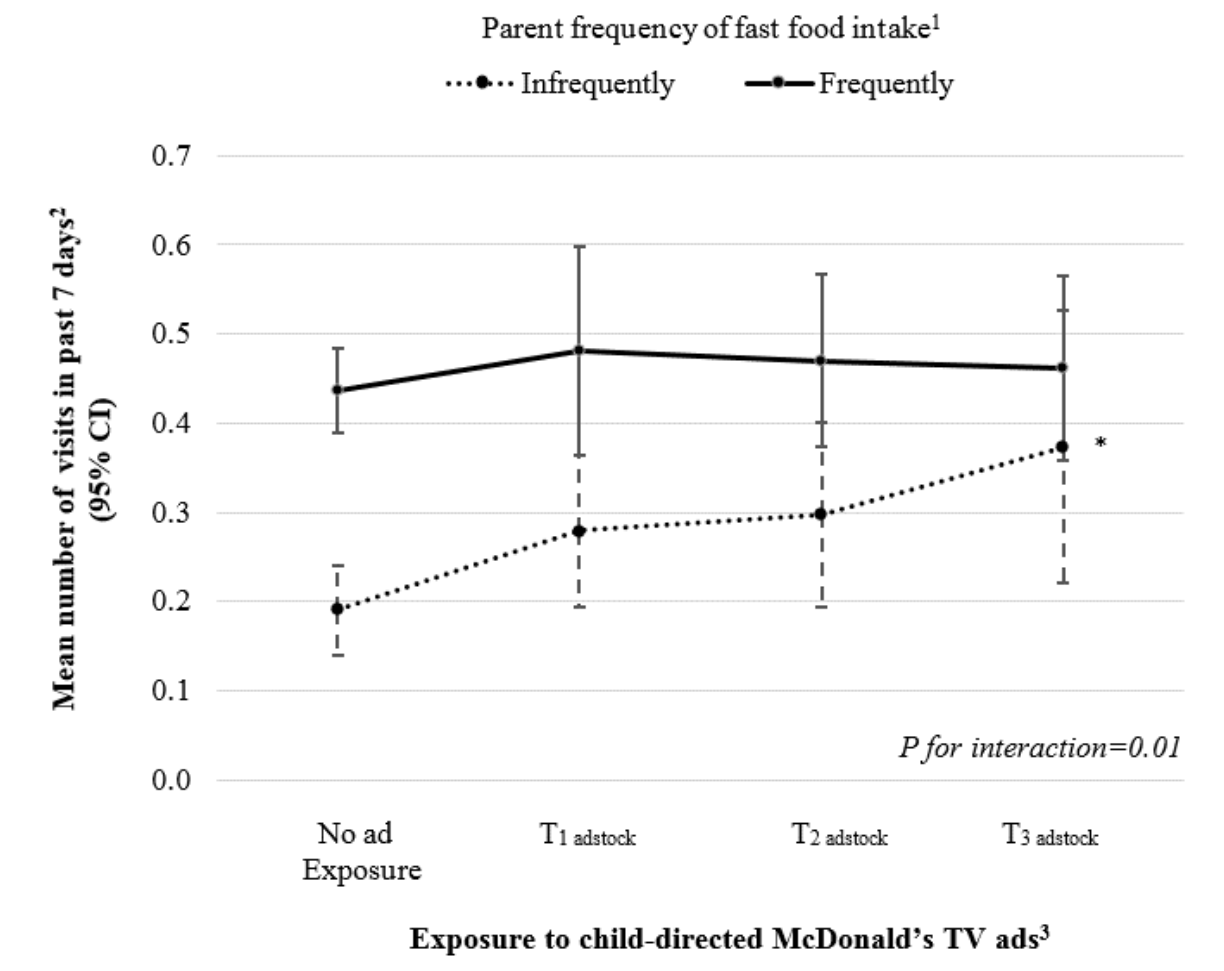
*$P<0.05$; †$P<0.001$
RR: Relative risk. IRR: Incidence rate ratio
Model adjusted for child age, gender, race/ethnicity and WIC recipient status; parent education; children's other screen time (hours per week) at baseline and TV time (hours per week) at each study survey, usual intake of McDonald's at baseline and parent's usual frequency of fast food intake at baseline.

Adjusted probability of any McDonald's intake in the past 7 days by the child by exposure to child-directed McDonald's TV advertisements, stratified by parent frequency of fast food intake.



Model adjusted for child age, gender, race/ethnicity and WIC recipient status; parent education; children's other screen time (hours per week) at baseline and TV time (hours per week) at each study survey and usual intake of McDonald's at baseline.

Adjusted mean frequency of McDonald's intake in the past 7 days by the child by exposure to child-directed McDonald's TV advertisements, stratified by parent frequency of fast food intake.



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IMPLICATIONS

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- Effects of child-directed TV advertising on children's dietary intake is *measurable in children's natural settings*
  - Exposure was related to children's intake of sugary breakfast cereals with differing brand-specific effects
  - Effects of exposure to child-directed McD's fast food ads on intake was modified by parental factors, possibly in unexpected ways
- Counters industry arguments that advertising effects on children's preferences and requests are not just limited to lab settings

THANK YOU

Jennifer A. Emond

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EXTRA SLIDES

Sample Characteristics (n=624)

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Weight status	
Healthy weight	447 (71.6%)
Overweight/obese	177 (28.4%)

PRIMARY EXPOSURE: ADSTOCK

- Adstock has been used to characterize the long-term, brand-specific effects of advertising on product sales, brand awareness, and consumption across a variety of products (e.g., market research panel studies).

(Clarke 1976, Broadbent 1976, Broadbent 2000, Leone 1995, Rizzo 1999, Clark 2009, Ross 2014, Siegel 2016)

ALCOHOLISM: CLINICAL AND EXPERIMENTAL RESEARCH

Vol. 38, No. 8
August 2014

The Relationship Between Brand-Specific Alcohol Advertising on Television and Brand-Specific Consumption Among Underage Youth

Craig S. Ross, Emily Maple, Michael Siegel, William DeJong, Timothy S. Naimi, Joshua Ostroff, Alisa A. Padon, Dina L. G. Borzekowski, and David H. Jernigan

PRIMARY EXPOSURE: ADSTOCK

- Example of adstock for a 6-week timeframe

Week	Ad exposure per week	Raw cumulative ad exposure	Adstock: cumulative ad exposure with 5% decay rate
1	100	100	100
2	100	200	195
3	100	300	286
4	0	300	271
5	0	300	255
6	0	300	245

MCDONALD'S IS THE PRIMARY RESTAURANT THAT MARKETS TO YOUNG CHILDREN

- In 2016 (Rudd):
  - McDonald's spent $32.9 million on all TV advertising for Happy Meals
  - A preschool-age child viewed, on average, 139 TV ads for McDonald's Happy Meals in that year
- In 2019 (from our preliminary data):
  - >$22 million on TV advertising for Happy Meals on just Disney XD, Nickelodeon, Nicktoons, and Cartoon Network.

Adjusted associations between children's exposure to child-directed McDonald's TV advertisements and any intake of McDonald's throughout the study, overall and in relation to parental frequency of fast food intake.

	Any McDonald's intake (yes vs. no), RR (95% CI)			
		Child McDonald's TV ad exposure[c]		
	No ad exposure	Lowest (tertile 1 of adstock)	Mid (tertile 2 of adstock)	Highest (tertile 3 of adstock)
% of Participants (mean)	65.9%	11.3%	11.3%	11.6%
All participants (n=624)	1.00 (Reference)	1.20 (1.00, 1.44)*	1.08 (0.92, 1.27)	1.14 (0.95, 1.36)
Stratified by parent frequency of fast food intake at baseline				
<Monthly (n=195)	1.00 (Reference)	1.85 (1.25, 2.73)†	1.84 (1.25, 2.71)†	2.04 (1.29, 3.23)†
≥ Monthly (n=429)	2.38 (1.84, 3.07)†	2.61 (1.93, 3.52)†	2.29 (1.73, 3.05)†	2.40 (1.77, 3.24)†

*P<0.05; †P<0.001

P for interaction term across strata < 0.01

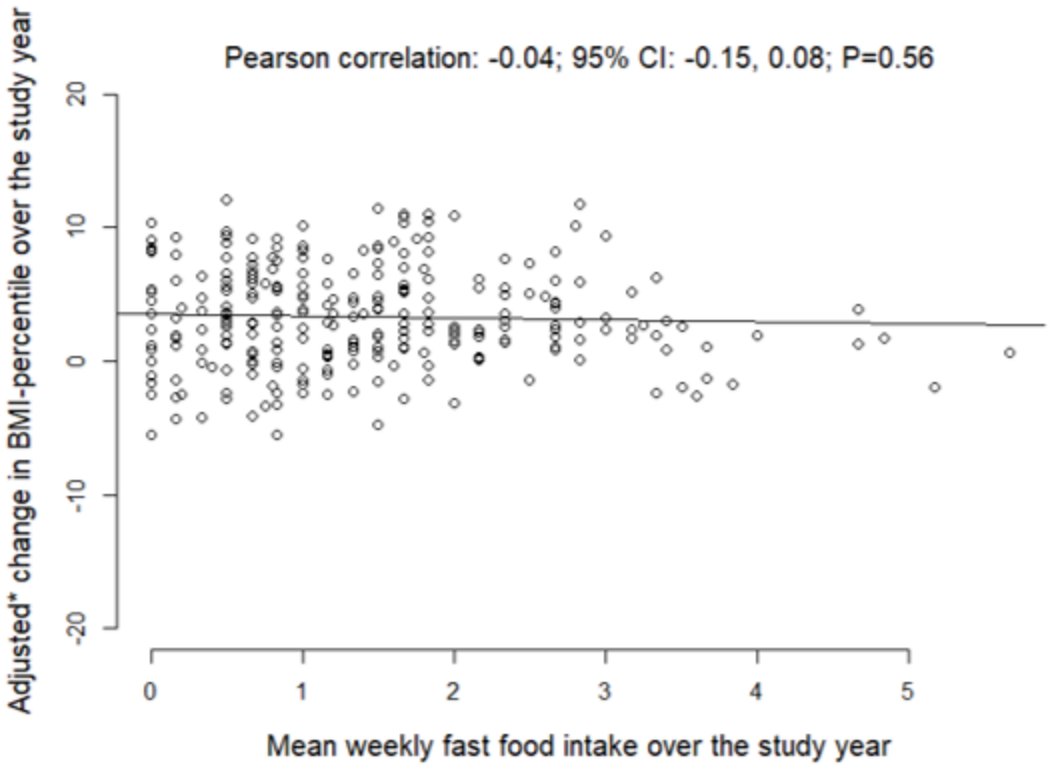
RR: Relative risk. IRR: Incidence rate ratio

Model adjusted for child age, gender, race/ethnicity and WIC recipient status; parent education; children's other screen time (hours per week) at baseline and TV time (hours per week) at each study survey and usual intake of McDonald's at baseline.

When stratified at the median value of BMI-percentile at baseline

(*P*-for-interaction=0.04)

Panel A: Among children with a baseline BMI <67th percentile.



Panel B: Among children with a baseline BMI ≥67th percentile.