

# Cost-effectiveness of a Sugar-sweetened Beverage Excise Tax

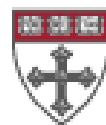
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8<sup>th</sup> Biennial Childhood Obesity Conference

San Diego, CA

June 30, 2015



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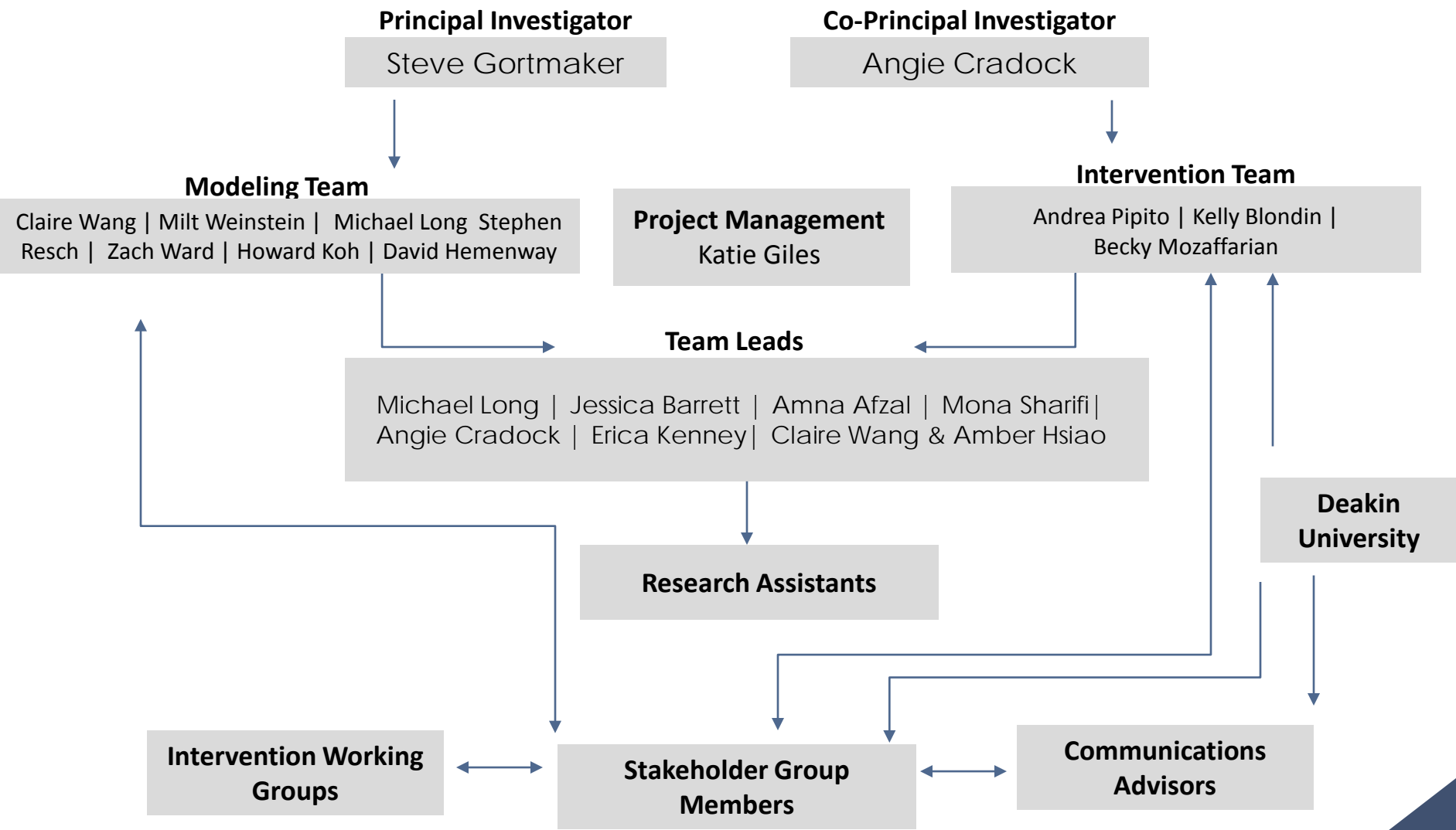
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# Financial Support

This work was supported in part by grants from the Robert Wood Johnson Foundation (66284) and CDC (U48/DP00064-00S1), including the Nutrition and Obesity Policy, Research and Evaluation Network, a Centre for Research Excellence in Obesity Policy and Food Systems supported by the Australian National Health and Medical Research Centre (grant number 1041020), the Donald and Sue Pritzker Nutrition and Fitness Initiative, and the JPB Foundation. This work is solely the responsibility of the authors and does not represent official views of CDC or any of the other funders.

The authors report no conflicts of interest.

# CHOICES Team



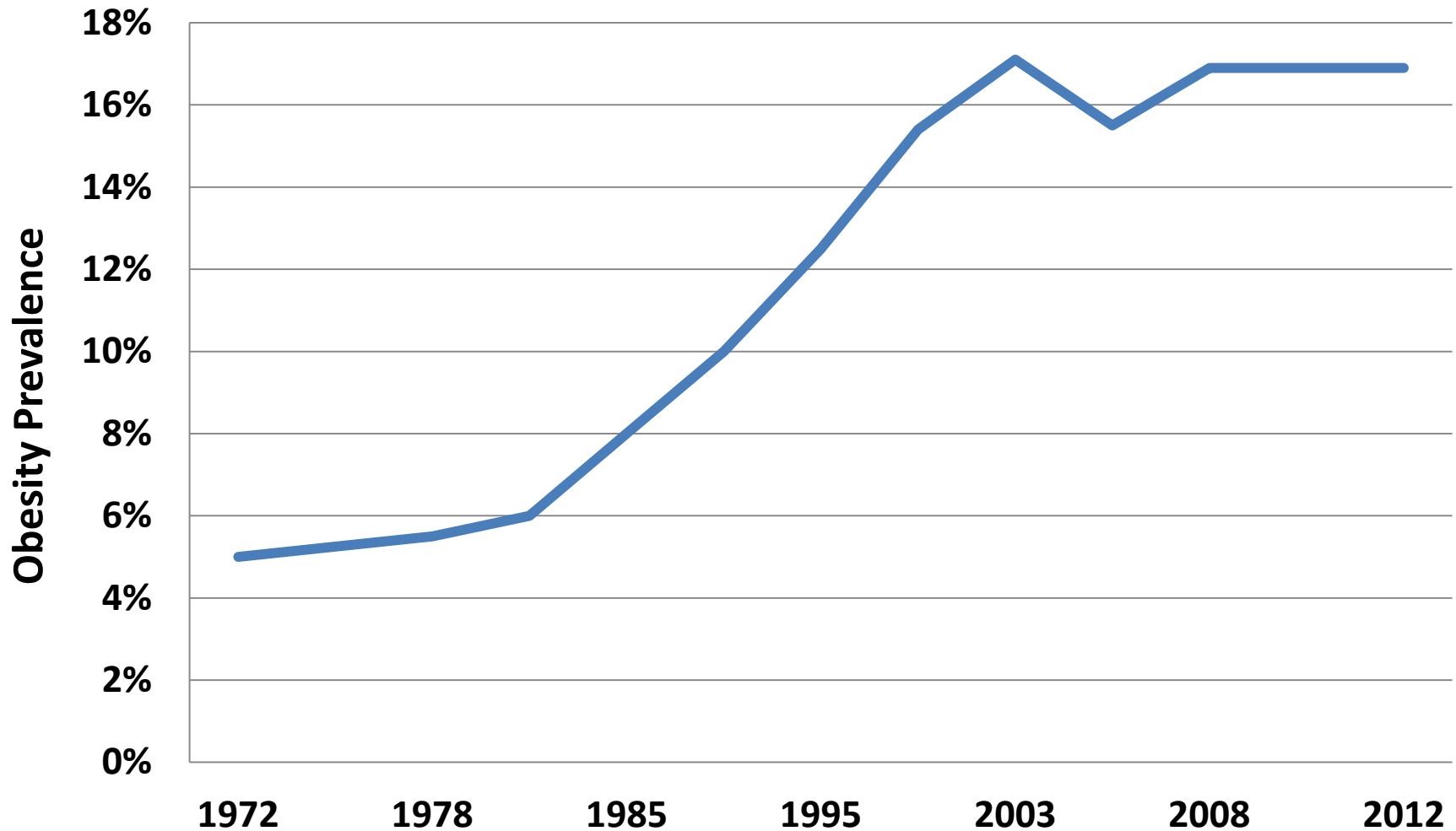
# CHOICES First Results

## **Five papers published in the July 2015 issue of the *American Journal of Preventive Medicine***

- Gortmaker et al. Cost-effectiveness of Childhood Obesity Interventions: Evidence and Methods for CHOICES.
- Long et al. Cost effectiveness of a sugar-sweetened beverage excise tax in the U.S.
- Sonnevile et al. BMI and healthcare cost impact of eliminating tax subsidy for advertising unhealthy food to youth.
- Wright et al. Modeling the cost effectiveness of child care policy changes in the U.S.
- Barrett et al. Cost effectiveness of an elementary school active physical education policy.

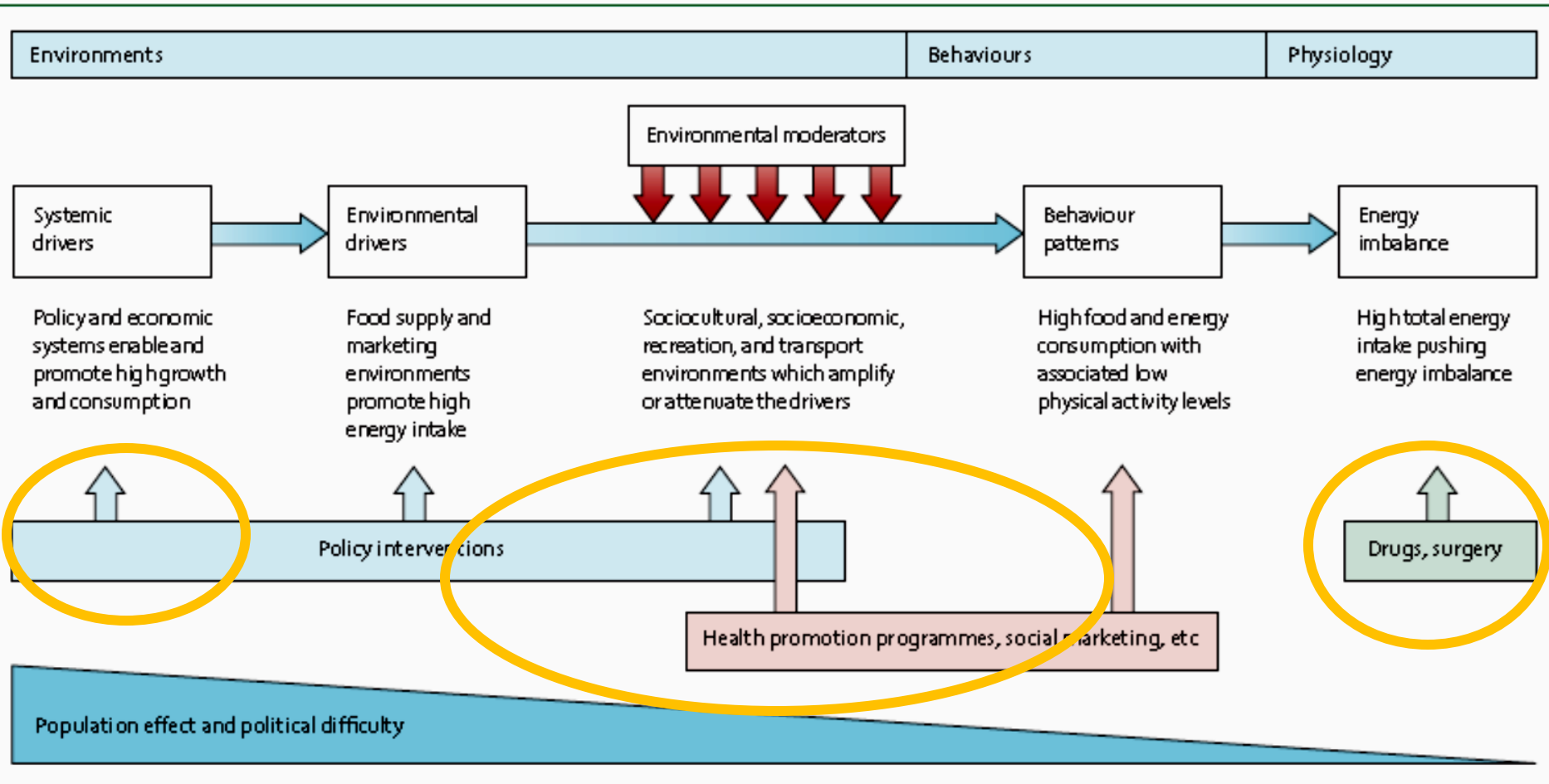
# History of U.S. Childhood Obesity Epidemic

## Childhood Obesity in the United States, 1971-2012



Source: NHANES 1972-2012

# Intervention Population Effect and Feasibility



# WHY FOCUS PUBLIC HEALTH EFFORTS ON REDUCING SSB INTAKE?



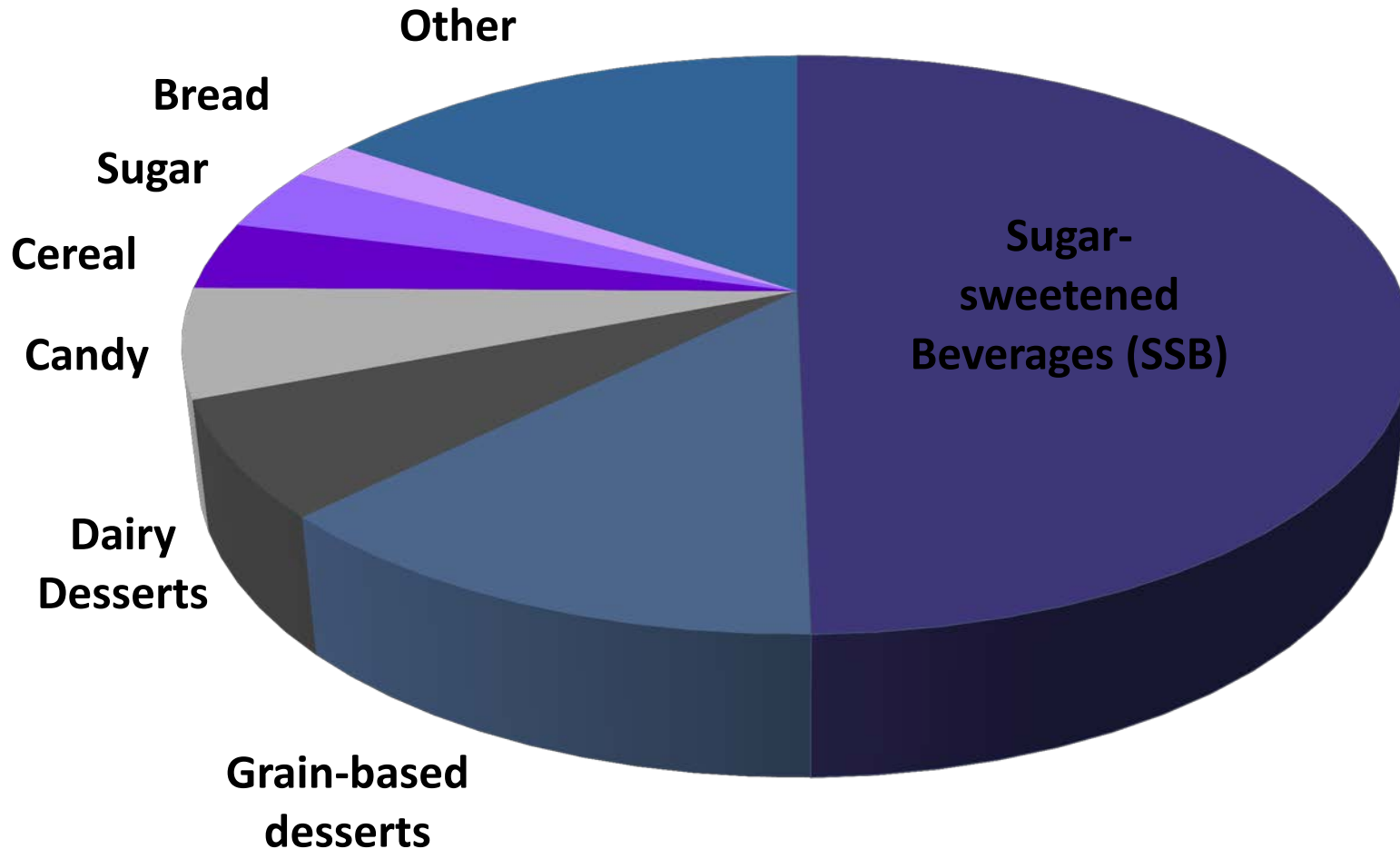
# U.S. Government Recommends Reducing SSBs

“Consume fewer and smaller portions of foods and beverages that contain solid fats and/or added sugars, such as grain based desserts, **sodas, and other sugar-sweetened beverages (SSBs).**”

*Dietary Guidelines for Americans, 2010*

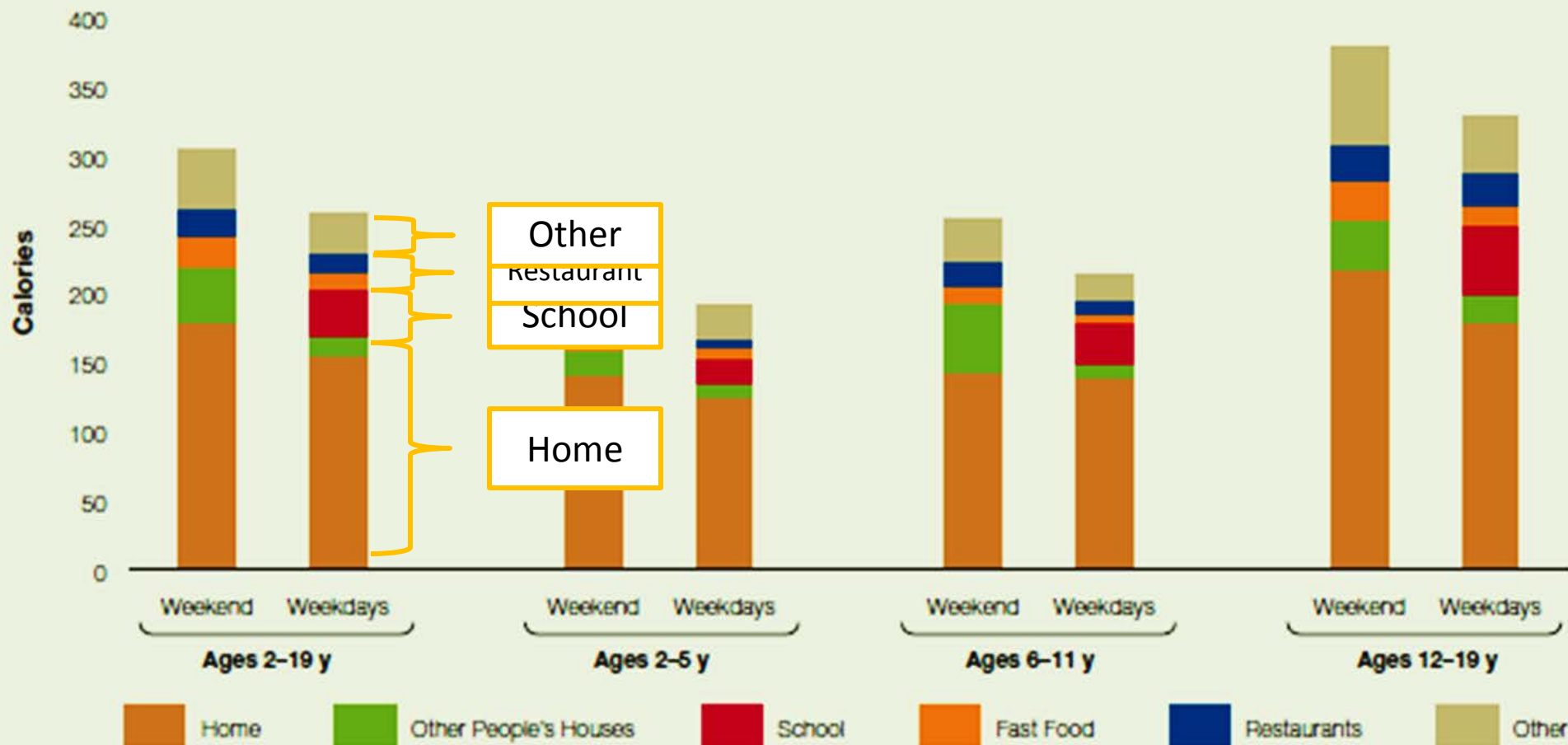


## Dietary Sources of U.S. Sugar Intake, 2005-2006



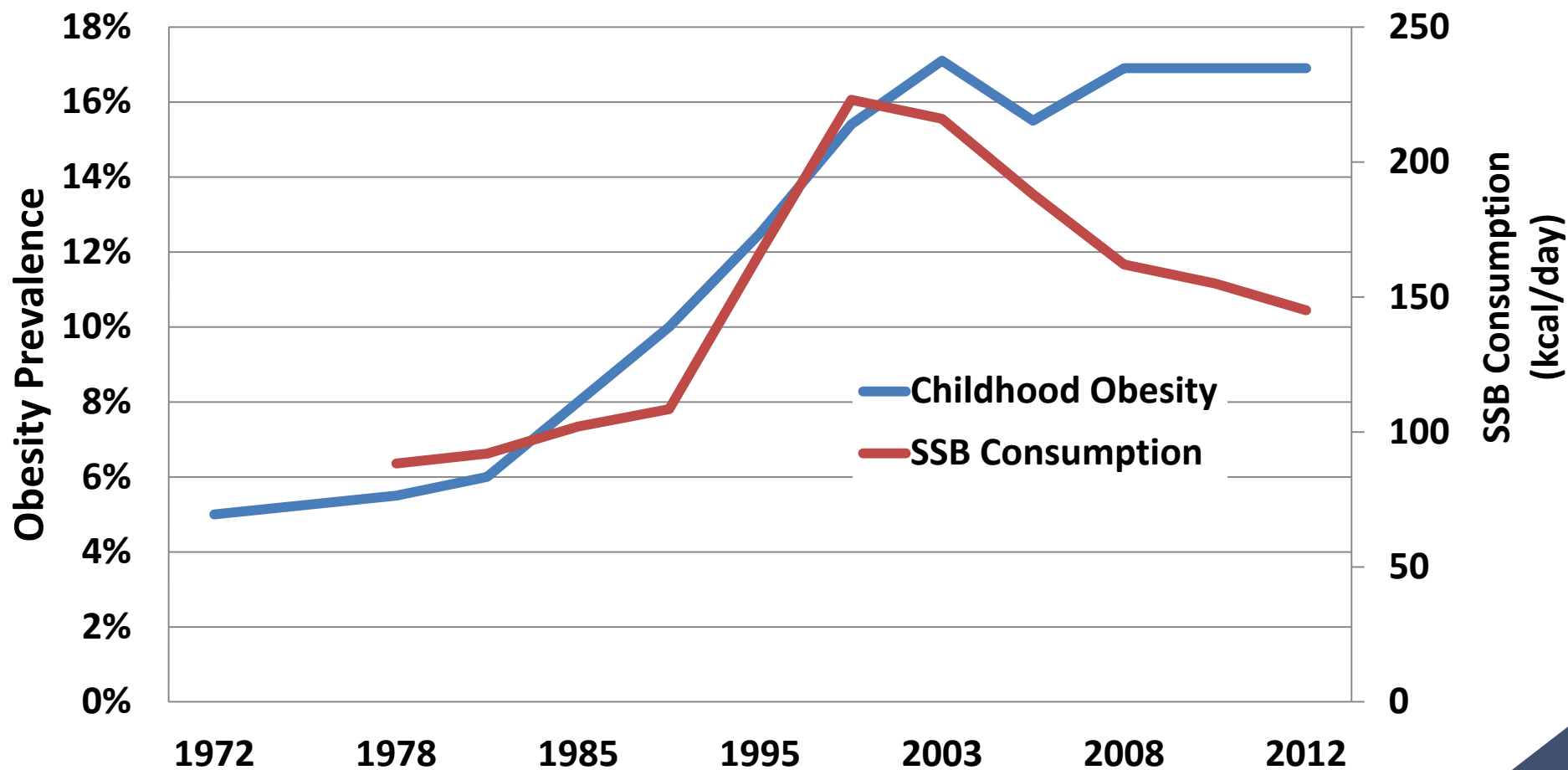
# Setting-specific U.S. SSB and Juice Intake

Figure 3: Location Where Children and Adolescents Consume SSBs and 100% Fruit Juice



# Trends in U.S. Childhood Obesity and SSB Intake

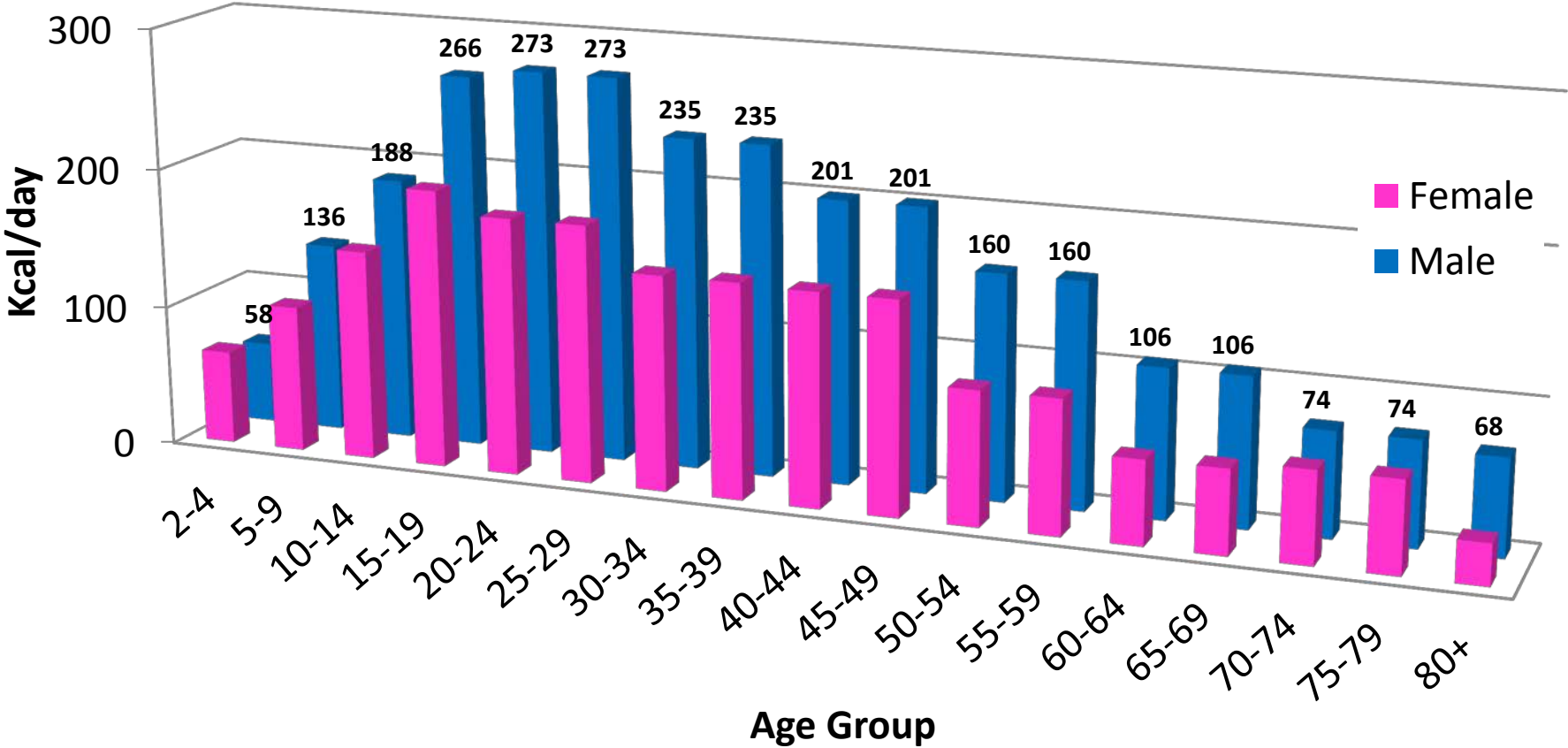
## Childhood Obesity and Youth Sugar-sweetened Beverage (SSB) Consumption (kcal/day) in the United States



Source: NHANES 1972-2012

# Current SSB Intake

**Sugar-sweetened Beverage Consumption (kcal/day) by Sex and Age Group, NHANES 2011-2012**



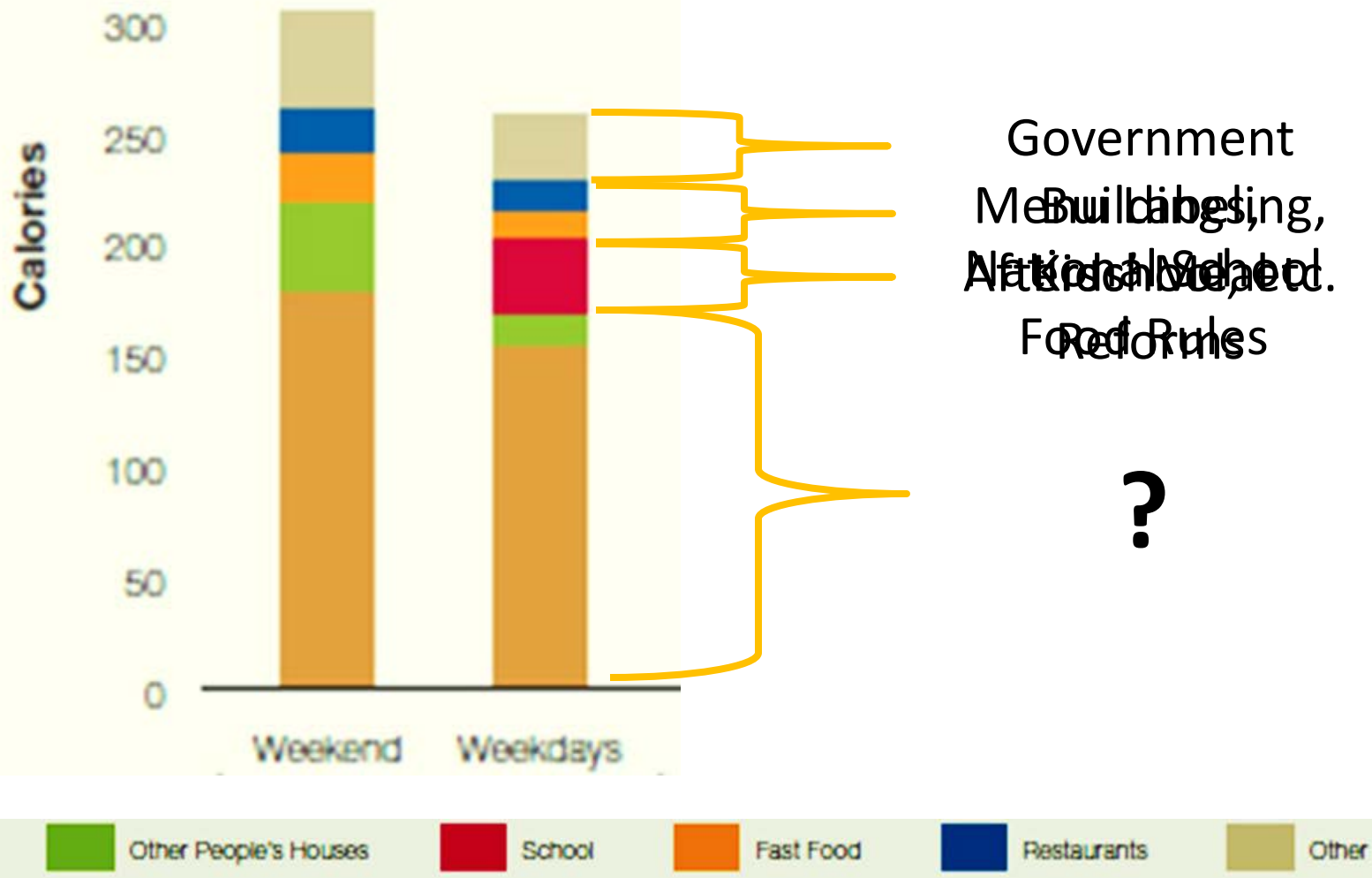
# U.S. Efforts to Reduce SSB Intake

- SSB consumption among youth has declined 35% from highest level
- Industry cooperation and national legislation substantially reduced SSB consumption at schools
- Public health efforts led to a shift in social norms highlighting negative health effects of SSBs
- SSB consumption among youth remains 64% higher than at start of U.S. epidemic

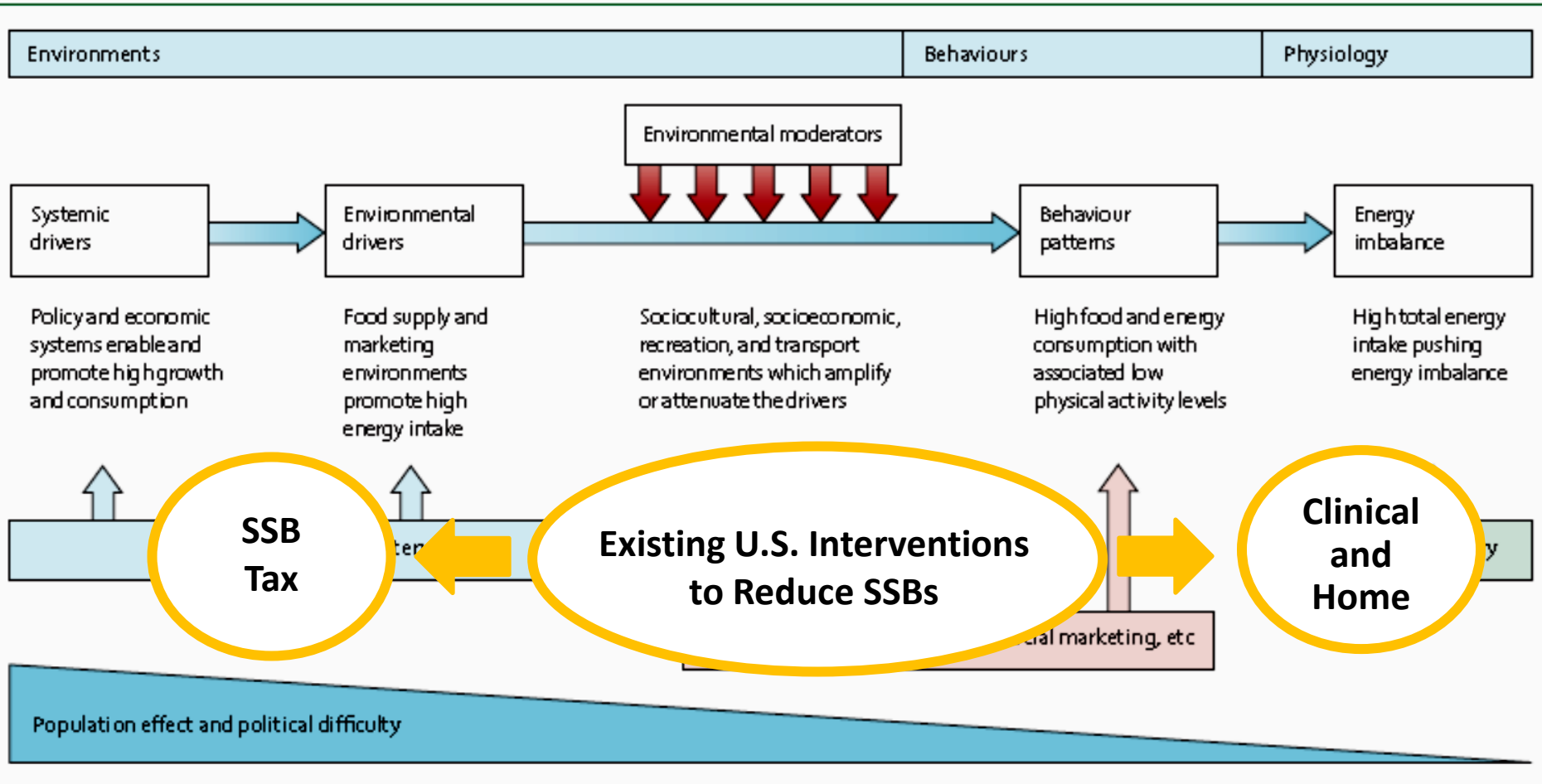
# Future National SSB Reduction Strategy Lacking

- Intensive clinical interventions could be effective, although likely expensive with potentially limited sustainability
- National restaurant menu calorie labeling may have small positive effect
- Cities have implemented a range of strategies:
  - Restrictions on sale and provision of SSBs in government buildings
  - Program and policies in afterschool and early childcare settings
  - Social marketing campaigns
  - Implementation varies widely by city and state

# Future National SSB Reduction Strategy Lacking



# Planning Future SSB Reduction Strategy





“Implement a tax strategy to discourage consumption of foods and beverages that have minimal nutritional value, such as sugar-sweetened beverages.”

U.S. Institute of Medicine

*Local Government Actions to Prevent Childhood Obesity*  
(2009)

# Limited SSB Tax Implementation in U.S.

- In 2013, one city and 12 states considered large excise or sales taxes on SSBs
- In November 2014, Berkeley, a small city in the U.S. state of California, became the first U.S. city to pass an SSB excise tax
- Public opinion polls frequently find majority support for SSB taxes
- SSB tax proposals met industry opposition and limited voter and policymaker support

# HOW COST-EFFECTIVENESS CAN HELP GUIDE FUTURE SSB STRATEGY



# Cost-effectiveness Needed for SSB Effort

- Public health officials and policymakers invested substantial time, money, and political will to achieve current reductions
- Research provides many options for further investment, but limited guidance on how to prioritize policymaking
- Opposition to SSB taxes requires strong data quantifying the health benefit of this approach

# Logic Model Linking SSB Tax to Health

$\Delta$  State  
Excise Tax



$\Delta$  SSB  
Price



$\Delta$  SSB  
Consumption



$\Delta$  BMI



$\Delta$  QALYs  
 $\Delta$  HC Cost

# Evidence for Policy Implementation

$\Delta$  State  
Excise Tax



$\Delta$  SSB  
Price



$\Delta$  SSB  
Consumption



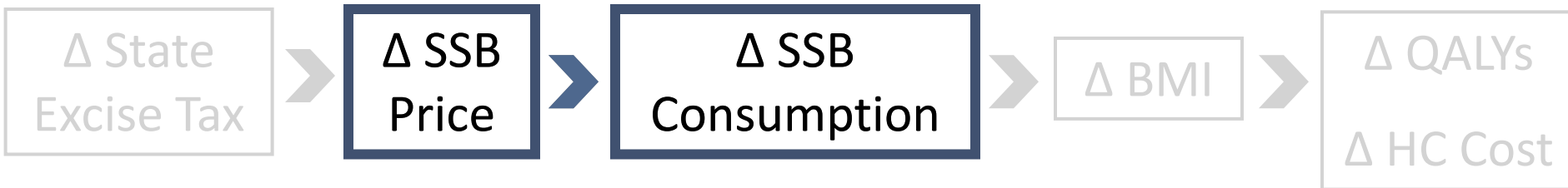
$\Delta$  BMI



$\Delta$  QALYs  
 $\Delta$  HC Cost

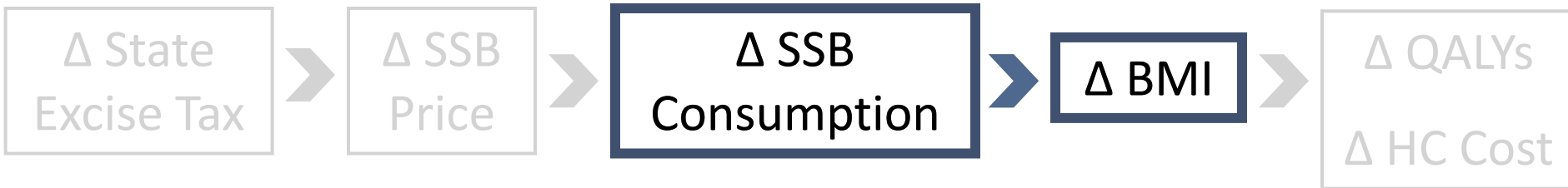
- \$0.01 per ounce excise tax on SSBs would raise prices by 16% in the United States (Powell 2014)
- Higher than the 10% tax implemented in Mexico

# Impact of Policy on Intermediate Outcome



- Systematic review of how consumers respond to price changes on SSBs (Powell 2013)
- 16% price increase would reduce SSB consumption by 20%
- This means that adolescents would drink ~45 fewer SSB calories every day

# Intermediate Outcome to Long-Term BMI



- Double-blind randomized trial in youth: 8oz SSB serving/day led to 1.01 kg weight gain (de Ruyter 2012)
- Four observational studies in adults: 12 oz SSB serving/day led to 0.21-0.57 BMI unit increase (Mozaffarian 2011; Chen 2009; Palmer 2008; Schulze 2004)



# Intermediate Outcome to Long-Term BMI



- We estimated reduction in obesity-related disease, healthcare cost and mortality due to SSB tax

# SSB Tax Intervention Cost

- Implementing a SSB excise tax in the U.S. would be relatively inexpensive
  - Limited number of bottlers and distributors
  - Existing tax infrastructure
  - Sales tax would require higher administrative and auditing costs
- Total cost to government and industry per year <1% of tax revenue

# Results

Intervention	Population Reach (millions)	First year intervention cost \$U.S. millions (UI)	Per Person BMI unit reduction (UI)	Cost per unit BMI reduction \$U.S. (UI)
Sugar-sweetened beverage (SSB) tax all ages	313	\$51 (\$36, \$66)	0.08 (0.03, 0.20) (adult)	\$3.16 (\$1.24, \$8.14)
SSB Tax ages 2-19 years only	74	\$51 (\$36, \$66)	0.16 (0.06, 0.37) (ages 2-19 years)	\$8.54 (\$3.33, \$24.2)

# Results

Intervention	Healthcare costs U.S. \$ millions (UI)	Net costs U.S. \$ millions (UI)	QALYs gained (UI)	Net cost saved per \$ spent (UI)
Sugar-sweetened beverage (SSB) tax all ages	-\$23,600 (-\$54,900, -\$9,330)	-\$23,200 (-\$54,500, -\$8,800)	871,000 (342,000; 2,030,000)	\$55 (\$21, \$140)

<sup>a</sup>Negative ICERs are not reported because they cannot be interpreted.

- Although not considered a benefit from the societal perspective, from the government's perspective the tax would generate:

**\$12.5 billion in 2014 dollars**

- Public support for SSB tax higher when revenue earmarked to healthcare or health promotion

## What about substitution to other foods and beverages in response to SSB reduction?

- Effect size from RCT in youth (de Ruyter) implicitly accounts for any changes in energy intake or expenditure
  - Effect is ~70% of what might be expected over this time period among children 8 years of age if there was no compensation
- Similarly, change-in-change estimates from observational studies in adults incorporate effect of all other behavioral changes
  - Effect is 10-40% of what would be expected with no compensation

# Scenario Analyses Testing Extreme Assumptions

- In addition to highest quality SSB consumption to weight/BMI estimate of compensation, we modeled additional scenarios:
  - Total energy intake compensation using short-term feeding studies
  - Total energy intake compensation using cross-price elasticities from juice and milk
  - Lowest identified elasticity: -0.69
  - Lower and higher pass through rates: 50% and 150%
  - Cost as 3% of revenue
- Proposed tax remained cost-saving across the range of alternative scenarios

# Health Equity

- Concerns regarding potentially regressive nature of SSB excise tax have been raised
- Empirical evidence on soda taxes demonstrates greater benefit for overweight children and children in African-American and low-income households
- Substantial revenue can be earmarked for progressive nutrition and public health programs



# SSB Tax Effect on Employment

- Previous industry studies have highlighted the potential negative effect of SSB taxes on employment
- Powell et al. (2014) estimated in California and Illinois:
  - SSB tax would lead to job losses in beverage industry
  - Overall employment would increase slightly. In California in 2012 estimate overall employment increase of 6,654 jobs (0.03% increase in employment)

# Will Tax Reduce Purchases?: Mexico Case study

- Mexico implemented an excise tax on SSBs of ~10% in January 2014
- June 2015 analysis by INSP and UNC team:
  - Compared to previous trends showed, 6% reduction in purchases throughout 2014, increasing to 12% reduction by the end of 2014
  - **Lower-income households: 17% decrease by December 2014**

# Inflation Adjustment of Specific Excise Tax

- \$0.01/oz has been the default SSB tax proposal for the last decade
- Since we began work on this issue, the tax declined from 22% of average retail price of SSB to 16%
- Experience of gas and alcohol specific excise taxes highlights challenge of adjusting specific excise taxes for inflation

# Estimating State and Local Level Revenue

- Rudd Center for Food Policy and Obesity (Andreyeva)

- Regional sales data from Beverage Marketing Corporation

Year:

State:  --or-- City:

**Calculate**

<b>Sugar-Sweetened Beverages*</b>	<b>Gallons per year</b>	<b>Tax Revenues per year</b>
Soft drinks	377,682,647	\$483,433,789
Fruit drinks	151,594,419	\$194,040,856
Sports drinks	117,579,537	\$150,501,807
Ready to drink tea	82,317,202	\$105,366,019
Energy drinks	117,708,034	\$150,666,284
Flavored water	12,314,855	\$15,763,014
Ready to drink coffee	13,327,833	\$17,059,626
<b>Total</b>	<b>872,524,526</b>	<b>\$1,116,831,394</b>

\*not including diet varieties

# Future Research

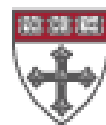
- Developing microsimulation model with valid estimates of state-level BMI distributions by combining:
  - Census
  - ACS
  - BRFSS
  - NSCH
  - NHANES
- Demographic-specific SSB consumption (potential to use regional NHANES data)
- State-level healthcare cost estimates accounting for shift in Medicaid population

# Thank you

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