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Research Informing Policies & Practices for Healthy Youth

Using Taxes to Influence Food Purchasing and Obesity

Workshop on Legal Strategies in Childhood Obesity Prevention
Standing Committee on Childhood Obesity Prevention
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Presentation Outline

- Objectives
- Individual-level and Tax Data
- Models
- Empirical Results
- Policy Implications

Taxation: Overview of Empirical Studies

Objectives, Data and Models

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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)
  - Monitoring the Future (MTF)
  - 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
  - Categorical indicators for state-level soda tax rates:
    a. Zero tax
    b. 0 < soda tax rate $\leq 4\%$
    c. 4% < soda tax rate $\leq 5\%$
    d. 5% < soda tax rate $\leq 6\%$
    e. Soda tax rate > 6%
  - Disfavored tax rate (soda tax rate – general food tax rate)
  - Disfavored dichotomous indicator (indicator if disfavored tax rate >0)

Models

Cross-Sectional Model:

$$Consumption/Weight_{ist} = \beta_0 + \beta_1 Tax_{st} + \beta_2 OC_{st} + \beta_3 X_{it} + \beta_4 D_{it} + \varepsilon_{ist}$$

Longitudinal Model:

$$Consumption/Weight_{ist} = \beta_0 + \beta_1 Tax_{st} + \beta_2 OC_{st} + \beta_3 X_{it} + \beta_4 D_{it} + v_i + w_{ist}$$

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

Soda Taxes and Consumption

A.C. Nielsen Homescan Data

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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, 2nd 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

Preliminary Results

OLS Regression Results: Soda Volume

	All Households	Households with Children	Households without Children
Disfavored Soda Tax Amount	-9.352**	-10.983**	-8.417**

Source: Loudermilk, Powell, Chriqui, and Chaloupka, *in progress*, 2010

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

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Objective

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

Data Description

- Nationally representative panel of elementary school students.
- Food consumption 5th 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 3rd to 5th grade (m=1.9)
- Control variables: age in months, race/ethnicity, family income, mother's education level, physical activity, TV watching, parent-child interactions.

Associations by Sub-populations

Outcome Variable	Total Consumption		School Consumption		BMI Change	
	Higher Soda Tax Amount	Higher Soda Tax Indicator	Higher Soda Tax Amount	Higher Soda Tax Indicator	Higher Soda Tax Amount	Higher Soda Tax Indicator
Full Sample	-0.004	-0.006	-0.010	-0.064*	-0.013*	-0.085**
At Risk of Overweight	-0.026	-0.078	-0.011	-0.067	-0.033**	-0.222**
Low-Income	-0.142*	-0.811	-0.039**	-0.239**	-0.000	-0.005
African American	-0.125	-0.767	-0.103**	-0.585**	0.029	0.086
9+ Hrs TV	-0.073	-0.376	-0.029**	-0.178**	-0.014	-0.091

Source: Sturm, Powell, Chriqui, and Chaloupka, *Health Affairs*, 2010

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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 3rd and 5th grade, or a 20% reduction in the excess BMI gain.

Soda Taxes and Adolescents' Weight

Monitoring the Future

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Objective

- To examine association of soda taxes with youths' BMI

Data Description

- Cross-section individual-level data for 8th, 10th, and 12th grade students,1997-2006
- Estimation sample includes 153,673 observations
- Outcome variable: body mass index (BMI)
- Control variables: gender, age, grade, race, ethnicity, student's hours work and income, parents' education, work, marital status
- Neighborhood controls: Food store and restaurant availability and per capita income

Associations between Taxes and BMI: Full Sample and by Sub-populations

	Grocery Store Soda Tax Rate	Presence of Grocery Store Tax	Disfavored Grocery Soda Tax Status	Disfavored Grocery Soda Tax Amount	Vending Machine Soda Tax Rate	Presence of Soda Vending Machine Tax
Full Model	**0.0131**	**0.0638**	**0.0735**	**0.0124**	**0.0110**	**0.0514**
By Weight Status						
At Risk of Overweight	**-0.0058**	**-0.0252**	**-0.0337**	**-0.0054**	**-0.0060***	**-0.0210**
Not at Risk	**0.0165**	**0.0809**	**0.0993**	**0.0166**	**0.0142**	**0.0665**
By Grade						
8th Grade	**0.0031**	**0.0429**	**0.0373**	**0.0043**	**0.0070**	**0.0590**
10th Grade	**0.0241**	**0.0997**	**0.1117**	**0.0212**	**0.0216**	**0.0873**
12th Grade	**0.0075**	**0.0400**	**0.0342**	**0.0043**	**-0.0101**	**-0.0478**
By Parents' Education						
Some College	**0.0160**	**0.0948**	**0.0985**	**0.0156**	**0.0146**	**0.0845**
Less than College	**0.0067**	**-0.0134**	**0.0003**	**0.0033**	**0.0017**	**-0.0354**

Source: Powell, Chriqui, and Chaloupka, *Journal of Adolescent Health*, 2009

Associations between Taxes and BMI: Full Sample and by Sub-populations

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Soda Taxes and Adolescents' Weight

National Longitudinal Survey of Youth 97

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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 11,900 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

Preliminary Regressions Results-Cross Sectional Analysis

	Female		Male	
	BMI	Overweight	BMI	Overweight
Full Sample				
0<tax≤4%	0.0552	0.0019	-0.0337	-0.0055
4%<tax≤5%	0.1339	0.0017	-0.1457	-0.0160
5%<tax≤6%	-0.0797	-0.0105	0.2203	0.1010
tax>6%	-0.0548	-0.0053	0.5410*	0.0257
Low Income				
0<tax≤4%	-0.5963	-0.0371*	-0.5030	-0.0556**
4%<tax≤5%	0.2401	-0.0094	-0.2245	-0.0073
5%<tax≤6%	-0.3359	-0.0436**	-0.1683	-0.0470**
tax>6%	-0.4483	-0.0369*	-0.4099	-0.0435**

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	BMI	Overweight	BMI	Overweight
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Preliminary Regressions Results-Longitudinal Analysis (FE)

	Female		Male	
	BMI	Overweight	BMI	Overweight
Full Sample				
0<tax≤4%	-0.7805**	-0.0078	-0.4054***	-0.0503
4%<tax≤5%	-0.7938**	-0.0153	-0.0942	-0.0369
5%<tax≤6%	-0.2033	0.0308*	-0.2297	-0.0591
tax>6%	-0.5647	0.0667*	0.4693	-0.0212
Low Income				
0<tax≤4%	-2.1950***	-0.0628***	-1.0196***	-0.0922***
4%<tax≤5%	-2.3600***	-0.0737**	-0.5907*	-0.0732***
5%<tax≤6%	-1.1818	-0.0162	-1.5229***	-0.0879***
tax>6%	-0.2139	0.0847	0.5069	-0.0969**

Source: Powell et al., *in progress*, 2010

Preliminary Regressions Results-Longitudinal Analysis (FE)

	Female		Male	
	BMI	Overweight	BMI	Overweight
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0<tax≤4%	-0.7805**	-0.0078	-0.4054***	-0.0503
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tax>6%	-0.2139	0.0847	0.5069	-0.0969**

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Summary: Policy Implications of Empirical Results

- Generally very small associations between soda taxes and consumption or weight outcomes based on the existing low tax rates which range up to just 7% in the study samples.
- Larger associations for populations at greater risk for obesity.
- *Substantial* increases in soda tax rates may have some measureable effects on outcomes and even greater effects at the population level.

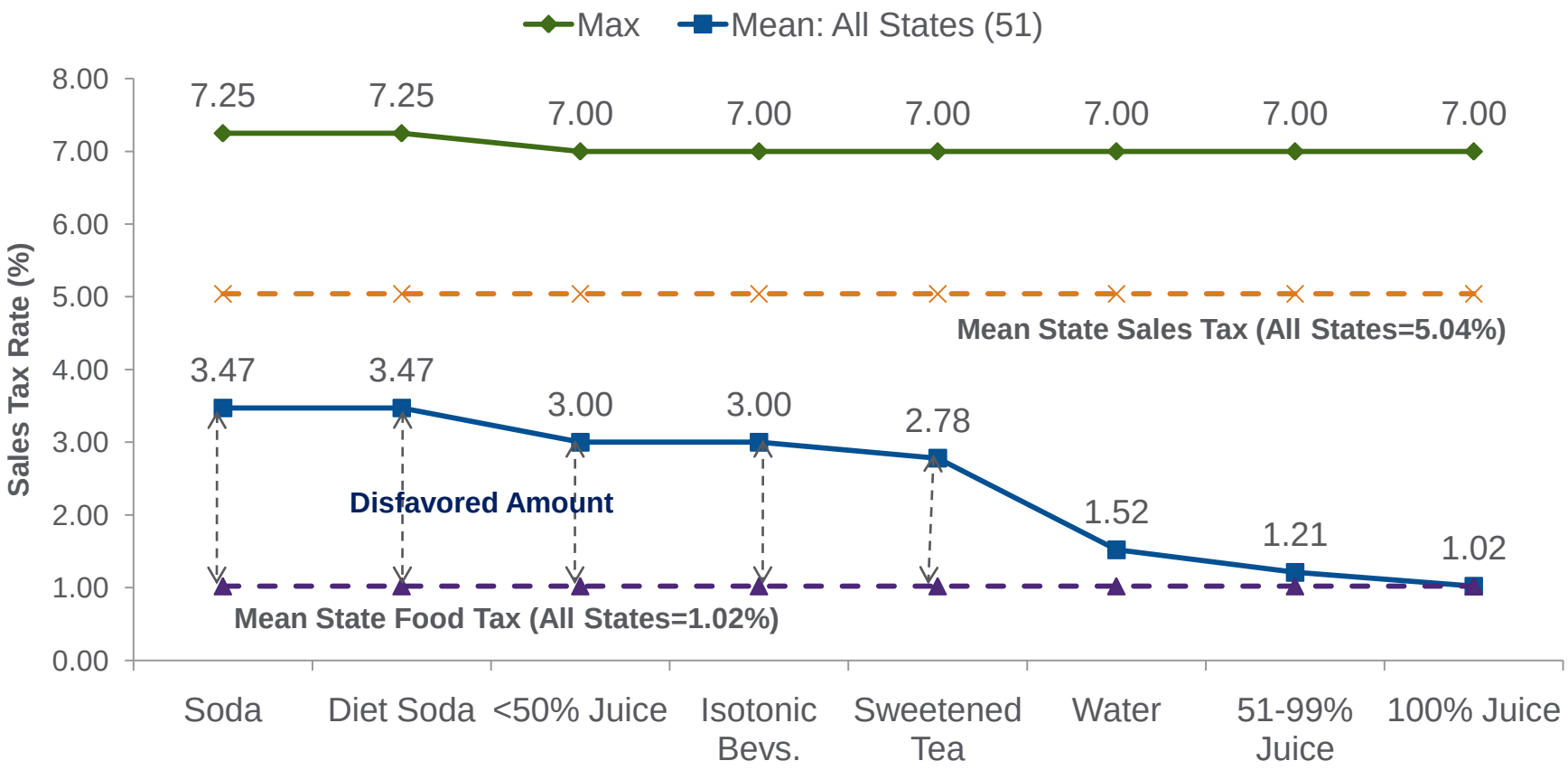
Policy Implications

Policy Landscape - Taxes

Food taxes have not generally been introduced with the aim of modifying consumption behavior as they have been used in other public health areas such as tobacco.

Food taxes are currently imposed on selected categories of food such as soft drinks, candy and snacks in grocery stores and vending machines but at quite **low tax rates**.

Sales Taxes on Selected Beverages, **All States** (as of July 1, 2010)



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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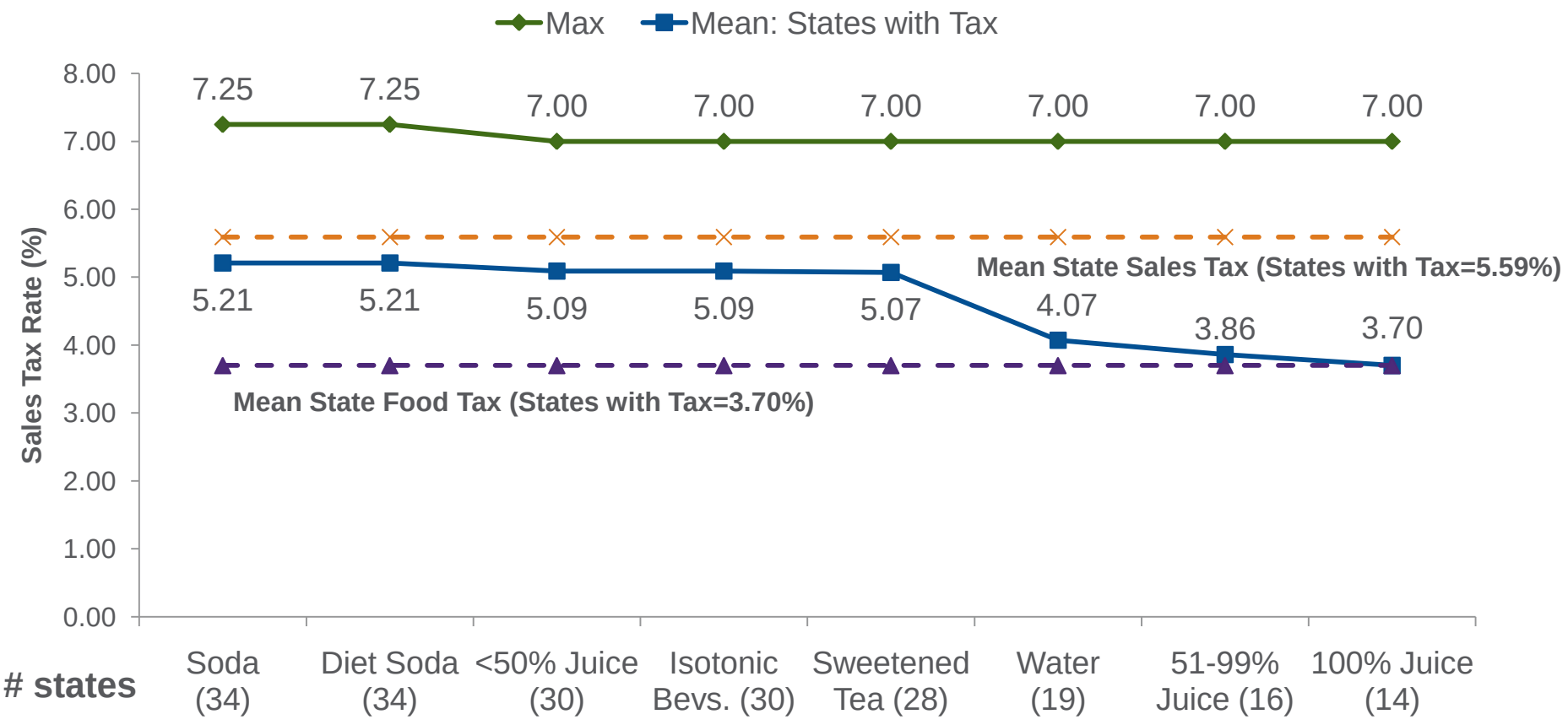
Sales Taxes on Selected Beverages, **Taxing States** (as of July 1, 2010)



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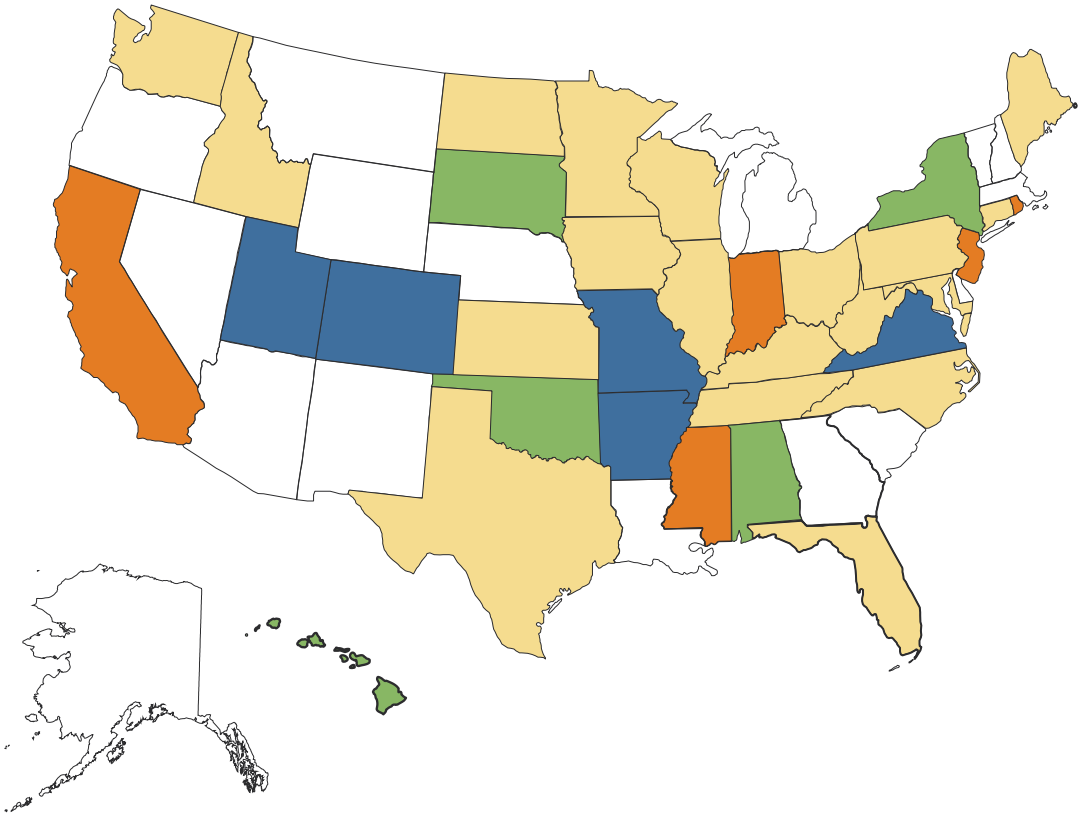
Sales taxes applied to vending machines sales, selected beverages (as of July 1, 2010)

	Mean all states (%)	Max (%)	N	Mean taxing states (%)
Soda	4.14	8.00	40	5.28
Diet Soda	4.14	8.00	40	5.28
≤ 50% fruit juice	4.02	8.00	39	5.26
Isotonic beverages	4.02	8.00	39	5.26
Sweetened teas (bottle/can)	3.90	8.00	38	5.24
Bottled water	3.38	8.00	34	5.07
>51% fruit juice, but < 100% fruit juice	3.30	8.00	33	5.10
100% fruit juice	3.30	8.00	33	5.10

State Sales Taxes on Regular and Diet Soda as of July 1, 2010



MAP LEGEND

- ≥ 7% (n=5 states)
- ≥5% to < 7% (n=19 states)
- ≥ 3% to < 5% (n=5 states)
- ≥1% to < 3% (n=5 states)
- 0% (n=16 states plus DC)

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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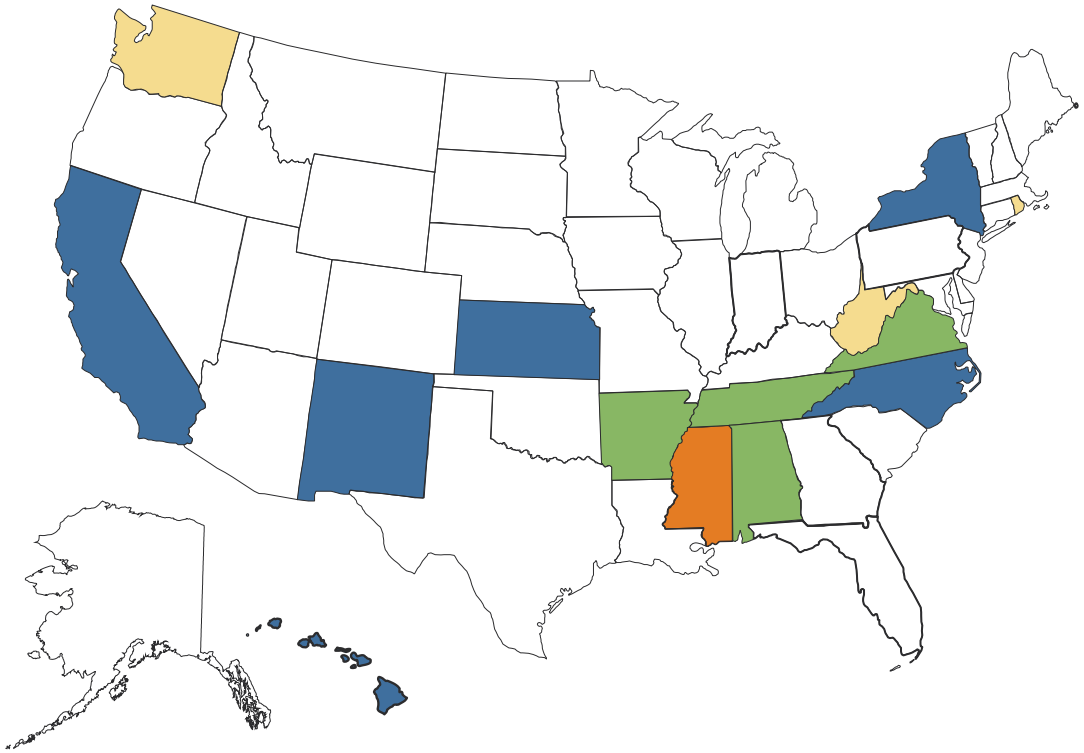
States with Non-Sales* Taxes on Selected Beverages (as of 7/1/10) or SSB-related Legislative Proposals in 2010



Map Legend

- States with excise taxes (N=3)*
- States with other license/privilege fees/ Taxes (N=4)*
- States with current SSB legislative proposals (N=8 ;includes RI with an existing tax)
- States with SSB legislative proposal that died (N=1)

*Additional excise/ad valorem (non-sales) taxes may be applied at the manufacturer, distributor, wholesaler, and/or retailer levels and are applied to bottles, syrup, powders and/or mixes. Taxes apply to regular and diet soda, isotonics, and sweetened tea in AL, AR, RI, TN, and WV. Taxes only apply to regular and diet soda in VA and WA.

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State SSB-related Legislative Activity, 2010 Legislative Session (includes carryover)—as of 8/27/10

8 states have introduced SSB-specific excise/ privilege tax bills during the current legislative session:

- **California** and **Kansas** (tax upon sweetened beverage manufacturers at a rate of $0.01/teaspoon sugar in SSB/concentrate)
- **Hawaii** (1% gross proceeds on sale of SSBs)
- **Mississippi** ($0.02/ounce or $2.56/gallon produced from syrup)—Died in Committee
- **New Mexico** ($0.005/ounce imposed on distributors)
- **New York** ($1.28/gallon bottled soft drinks; $1.28/gallon soft drink produced from powder/mix; $7.68/gallon of syrup)
- **Rhode Island** ($0.05/20 ounces or $0.10/>20 ounces) – in addition to existing non-sales taxes
- **South Carolina** ($0.01/13.5 grams of concentrate of sugar placed into SSB concentrate imposed on manufacturers)

City-level tax proposals

- **Philadelphia** - $0.02/ounce – Died in City Council
- **Washington DC** - $0.01/ounce – Died in DC Council (but did extend sales tax base to include SSBs effective 10/1/10)

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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.
  - Dedication of tax revenue to nutrition and physical activity programs

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