Cost-effectiveness of a Sugar-sweetened Beverage Excise Tax

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CHOICES First Results

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


- Long et al. Cost effectiveness of a sugar-sweetened beverage excise tax in the U.S.

- Sonneville 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?
“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
SSBs 50% of Total Added Sugar in American Diet, 2005-2006

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

- Sugar-sweetened Beverages (SSB)
- Grain-based desserts
- Dairy desserts
- Candy
- Cereal
- Sugar
- Bread
- Other

Source: United States Dietary Guidelines for Americans, 2010
Setting-specific U.S. SSB and Juice Intake

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

**Age Group**
- 2-4
- 5-9
- 10-14
- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- 40-44
- 45-49
- 50-54
- 55-59
- 60-64
- 65-69
- 70-74
- 75-79
- 80+

**Kcal/day**
- Female
- Male
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

Government
Buildings, National School
Reforms

Planning Future SSB Reduction Strategy

Existing U.S. Interventions to Reduce SSBs

“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

△ State Excise Tax ▸ △ SSB Price ▸ △ SSB Consumption ▸ △ BMI ▸ △ QALYs △ HC Cost
Evidence for Policy Implementation

- $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
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
Interim 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)
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

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

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

*Negative ICERs are not reported because they cannot be interpreted.*
Tax Revenue

- 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
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

### Sugar-Sweetened Beverages

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

*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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