

Association of media and messaging on the impact of the Seattle sugar-sweetened beverage
tax

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Abstract

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Consumption of sugar-sweetened beverages (SSB) has been linked with poor health outcomes such as Type 2 Diabetes, cardiovascular disease, metabolic syndrome, and obesity. Public health and policy experts have been increasingly turning to fiscal policy as a potential strategy to lower consumption of excess sugar from SSBs. However, there is evidence that the public acceptance and success of such policies depends on public support. This study builds on this prior work to investigate the impact of public support and the importance of messaging (hearing or reading anything about the tax) on lowering consumption of SSBs. A cross-sectional, population-based, mixed-mode survey of Seattle residents was conducted in 2019, following implementation of the Seattle SSB tax. Twenty-five percent of participants reported seeing, hearing, or reading something positive about the Seattle SSB tax, and 45% reported seeing, hearing, or reading something negative about the tax. For participants exposed to negative messaging about the tax, the odds of reporting a lowering of SSB consumption due to the tax were 3.12 times higher (Odds Ratio [OR]: 3.12; 95% Confidence Interval [CI]: 1.92, 5.07) compared to those not exposed to negative messaging. The odds of lowering SSB consumption did not significantly differ between participants exposed to positive messaging and those not exposed (OR: 0.60; 95% CI: 0.35, 1.03). Results suggest that any messaging about the SSB tax is associated with lowering SSB consumption.

INTRODUCTION

Consumption of sugar-sweetened beverages (SSB) is a key source of added sugar intake worldwide.¹⁻³ In the US, over one quarter of adults report consumption of at least one SSB every day.⁴ Intake of both added sugar and specifically SSBs have been associated with poor health outcomes such as obesity, metabolic syndrome, cardiovascular disease, and Type 2 Diabetes.⁵⁻⁸

Taxes on SSBs have been suggested as a strategy to lower consumption. Due to the price elasticity of demand on food, it is thought that substantially raising the price of SSBs will lower demand and therefore lower consumption of SSBs.⁹ This approach has quickly gained popularity following endorsement of SSB taxes in 2016 by the World Health Organization as a part of their measures to address childhood obesity.¹⁰

Since Berkeley implemented the first tax of its kind in 2015, several other jurisdictions in the US have followed suit: Boulder, Colorado, Cook County, Illinois, Philadelphia, Pennsylvania, and in January 2018, Seattle, Washington. Initial evidence from US cities that have implemented SSB taxes is promising. Evaluations of these taxes have shown an increase in SSB prices and a sustained decrease in sales volume.¹¹⁻¹³ Additionally, in the years following implementation of a SSB tax in 2015, Berkeley, California saw sustained reductions in consumption.¹⁴ One year after a SSB tax was enacted in Philadelphia, Pennsylvania, consumption of soda was found to be 31% lower than before the tax.¹⁵ In Seattle, prices of SSBs have increased,¹⁶ purchasing of SSBs has decreased by over 20%, and there has been minimal evidence of substitution with other items such as sweet or salty snacks, or other untaxed beverages.^{17,18}

Although some municipalities have been successful in implementation of SSB taxes, initially, lack of public support for such taxes has prevented implementation of SSB taxes in many areas around the US.¹⁹ A 2012 national survey showed that only 22% of respondents supported implementation of a SSB tax.²⁰ Another national survey conducted in 2011 showed that the majority of respondents agreed with anti-tax arguments (“tax on SSBs is arbitrary because it does not affect consumption of other unhealthy foods”, “just a quick way for politicians to fill budget holes”), while no pro-tax arguments were supported by more than 50% of respondents.²¹

In the short time since these surveys were conducted, support for SSB taxes has increased, and support is especially high among democrats and young people.²² It has become clear that how the tax is presented is vital to public acceptance of SSB taxes.¹⁹ Support for SSB taxes is higher when the tax is framed as a measure to prevent obesity, and when tax revenue

will be used for health-related programs.^{19,23} It is known that framing impacts support of SSB taxes, but it is unknown how framing and messaging about the tax after implementation might impact tax success in terms of consumption. The current study explores the association of exposure to positive or negative messaging with self-reported change in consumption of SSBs due to the tax, and whether the relationship differs based on education level or political party affiliation.

METHODS

Study design

The Seattle SSB tax was enacted on January 1, 2018. Large distributors are taxed 1.75 cents per ounce for beverages with added sugars. Revenue from the tax is invested in programs that increase access to healthy food, support education for preschool aged children, and help high school graduates enter college.²⁶

A cross-sectional, population-based, mixed-mode survey of Seattle residents was conducted in 2019 to assess attitudes and perceptions about the tax and its impact, as well as attitudes and knowledge about the healthfulness of SSBs. Survey topics included demographics, self-reported consumption and change in consumption, knowledge about the tax, and exposure to messaging related to the tax.

Data collection and study population

The survey was administered by a survey research firm, Ironwood Insights Group, LLC., either by phone or online, between September and November 2019. Phone survey participants were selected using a stratified random sampling approach. Phone numbers were sampled from all working cell phone and landline phones in Seattle. Participants of the online survey were sampled from existing panels of individuals who previously completed online surveys or opted-in to complete surveys online.

The survey was offered in English and Spanish (phone and online), as well as Vietnamese (online only). Seattle residents 18 and older were eligible to participate. Individuals who refused to answer screening questions about income or race/ethnicity, who did not speak or read English or Spanish, or did not read Vietnamese were ineligible to participate.

Lower-income households were oversampled to allow for testing of differences in norms and attitudes by income level. Lower-income was defined as <260% of the Federal Poverty Level (FPL). A total of 789 participants in Seattle were recruited, of which 353 were lower-

income participants. The University of Washington School of Public Health Institutional Review Board determined that this study was exempt.

Measures

Exposure. The exposure of interest was exposure to messaging about the Seattle SSB tax. Exposure to messaging was based on two survey questions. The first asked about positive messaging: “In the past 6 months, have you seen, heard, or read anything *positive* about the sugary drink tax?” The second question asked about negative messaging in the same format. As the exposure is not mutually exclusive, participants could have reported exposure to either positive or negative messaging, both, or neither. Many participants responded that they were “unsure” whether they had been exposed. These participants were included in the unexposed group. Participants who stated that they had not heard of the tax, and therefore were not asked these two questions, are unexposed to both positive and negative messaging. The exposure was modeled with two indicator variables, one for exposure to positive messaging (i.e., 1 for positive exposure, else 0) and one for exposure to negative messaging.

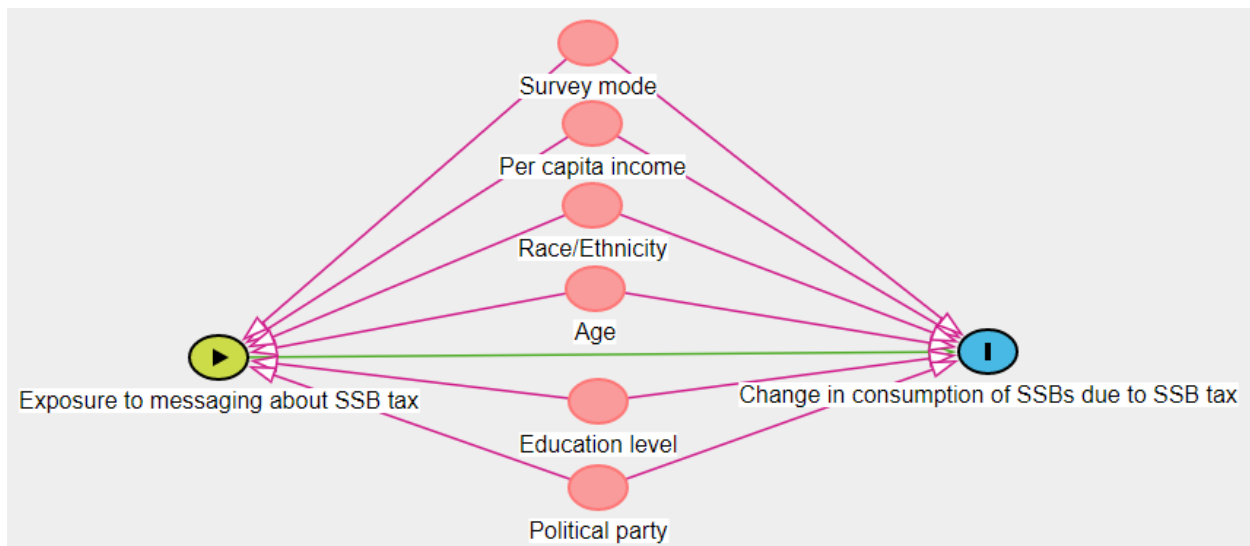
Outcome. The outcome was drinking less SSBs in the past year due to the SSB tax (self-reported). Participants were asked “Have you changed how much you drink sugary drinks in the last year?” and if they answered “Yes” they were then prompted to answer whether the change was “More” or “Less.” Participants who answered “Less” were then asked, “Was the sugary drink tax and/or its campaign one of the reasons you drank less?” Participants who answered “Yes” to this question were categorized as drinking less SSBs due to the tax, and all other participants were categorized as not drinking less SSBs (1=drank less SSB due to tax, else 0).

Effect modifiers. Two potential effect modifiers were examined in this analysis: education level and political party association. Education level was dichotomized as having a college degree or higher versus less than a college degree. Political party association was based on the survey question: “Generally speaking, do you think of yourself as a Democrat, an Independent, a Republican, or what?” Possible answers included Democrat, Independent, Republican, and Other. Both education level and political party were also included as confounders.

Confounders. Confounders were selected a priori based on a causal diagram, **Figure 1**. This analysis includes age, race/ethnicity, per capita income, and mode of survey collection as confounders. Age was categorized as 18-30, 31-40, 41-50, 51-64, and 65+. Race/ethnicity was categorized as non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanics of “Other” race, or Hispanic. Native Hawaiian or other Pacific Islanders, American Indian and

Alaska Natives, and those reporting two or more races are categorized as non-Hispanic Other due to low numbers. Income was collected as household income with the following categories: <\$30,000, \$30,000-\$59,999, \$60,000-\$89,999, \$90,000-\$120,000, and >\$120,000. To find per capita income, the midpoint of the household income category (or \$135,000 for the >\$120,000 category) was divided by household size. Mode of survey completion was either online or by phone.

Figure 1. Causal diagram for Aim 1.



Statistical analysis

A logistic regression model was used to test for an association between exposure to messaging about the SSB tax and change in consumption due to the tax, controlling for per capita income, race/ethnicity, age, survey mode, education level, and political party. Individual tests for positive exposure (controlling for negative exposure) and negative exposure (controlling for positive exposure), as well as an overall test for an association regardless of messaging type were conducted.

Model 1: $\text{logit}(p) = \alpha + \beta_1\text{POS} + \beta_2\text{NEG} + \gamma_1\text{AGE} + \gamma_2\text{RACE} + \gamma_3\text{INCOME} + \gamma_4\text{MODE} + \gamma_5\text{EDU} + \gamma_6\text{POLI}$

Two additional models were created to investigate whether the association between messaging exposure and change in SSB consumption due to the tax is modified by either

education level or political affiliation. The second model builds off Model 1 by adding interaction terms between education level and both positive and negative messaging.

$$\text{Model 2: } \text{logit}(p) = \alpha + \beta_1\text{POS} + \beta_2\text{NEG} + \gamma_1\text{AGE} + \gamma_2\text{RACE} + \gamma_3\text{INCOME} + \gamma_4\text{MODE} + \gamma_5\text{EDU} + \gamma_6\text{POLI} + \delta_1\text{EDU*POS} + \delta_2\text{EDU*NEG}$$

The third model includes interaction terms between political affiliation and both positive and negative messaging.

$$\text{Model 3: } \text{logit}(p) = \alpha + \beta_1\text{POS} + \beta_2\text{NEG} + \gamma_1\text{AGE} + \gamma_2\text{RACE} + \gamma_3\text{INCOME} + \gamma_4\text{MODE} + \gamma_5\text{EDU} + \gamma_6\text{POLI} + \delta_1\text{POLI*POS} + \delta_2\text{POLI*NEG}$$

For each model, individual Wald tests for each interaction term were conducted. As political affiliation is a categorical variable with five levels, a 4 degree of freedom Wald test was conducted for each interaction term in Model 3.

Sensitivity analyses were conducted to assess the appropriateness of modeling the exposure as two mutually exclusive indicator variables. A single exposure variable was created with the following levels: no exposure, positive exposure, negative exposure, and both exposures. Individual tests for positive exposure, negative exposure, and exposure to both messaging types were conducted, as well as an overall test for an association regardless of messaging type.

RESULTS

There were a total of 789 participants who completed the survey either online or by phone. We excluded 43 participants (5.4%) due to missing responses for confounding variables, resulting in a final sample of 746 individuals.

The majority (69%) of study participants were non-Hispanic White, over half (58%) had a college degree or higher, and 54% reported affiliation with the Democratic party (**Table 1**). Due to purposeful oversampling in recruitment, lower income households were overrepresented in the sample, with 57% reporting a per capita income of less than \$30,000. One quarter of participants (25%) reported seeing, hearing, or reading something *positive* about the Seattle SSB tax. About half of participants (45%) reported seeing, hearing, or reading something *negative* about the tax.

Among this sample, 109 (15%) reported lowering their consumption of SSBs in the past year due to the SSB tax. Participants who reported lowering their SSB consumption had lower per capita income, took the survey online, and were generally younger (ages 18-40), though 29% of those who reported lowering their SSB consumption were ages 51-64, compared to 24% of those who did not lower consumption. A majority (64%) of participants who reported lowering their consumption of SSBs due to the tax reported exposure to negative messaging about the tax, while only 41% of those who did not report lowering their consumption of SSBs reported exposure to negative messaging about the tax. About one quarter of participants reported exposure to positive messaging within both groups: those who reported lowering their consumption of SSBs due to the tax (25%), and those who did not lower consumption (23%).

Table 1. Characteristics of survey participants by SSB consumption status

	Lowered SSB consumption due to SSB tax		Total (N=746)
	No (N=637)	Yes (N=109)	
Age			
18-30	113 (18%)	29 (27%)	142 (19%)
31-40	124 (19%)	26 (24%)	150 (20%)
41-50	107 (17%)	12 (11%)	119 (16%)
51-64	152 (24%)	32 (29%)	184 (25%)
65+	141 (22%)	10 (9%)	151 (20%)
Race/Ethnicity			
Non-Hispanic White	443 (70%)	70 (64%)	513 (69%)
Non-Hispanic Black	42 (7%)	10 (9%)	52 (7%)
Non-Hispanic Asian	60 (9%)	10 (9%)	70 (9%)
Non-Hispanic Other	52 (8%)	6 (6%)	58 (8%)
Hispanic	40 (6%)	13 (12%)	53 (7%)
Per capita household income			
<\$30,000	349 (55%)	79 (72%)	428 (57%)
\$30,000-\$59,999	201 (32%)	23 (21%)	224 (30%)
\$60,000-\$89,999	69 (11%)	5 (5%)	74 (10%)
\$90,000-120,000	13 (2%)	1 (1%)	14 (2%)
>120,000	5 (1%)	1 (1%)	6 (1%)
Education level			
Less than college degree	264 (41%)	53 (49%)	317 (42%)
College degree or higher	373 (59%)	56 (51%)	429 (58%)
Political affiliation			
Democrat	341 (54%)	62 (57%)	403 (54%)
Independent	181 (28%)	30 (28%)	211 (28%)

	Lowered SSB consumption due to SSB tax		Total (N=746)
	No (N=637)	Yes (N=109)	
Republican	59 (9%)	12 (11%)	71 (10%)
Other	26 (4%)	1 (1%)	27 (4%)
Don't know	30 (5%)	4 (4%)	34 (5%)
Survey mode			
Online	426 (67%)	84 (77%)	510 (68%)
Phone	211 (33%)	25 (23%)	236 (32%)
Exposure to positive messaging			
No	476 (75%)	84 (77%)	560 (75%)
Yes	161 (25%)	25 (23%)	186 (25%)
Exposure to negative messaging			
No	373 (59%)	39 (36%)	412 (55%)
Yes	264 (41%)	70 (64%)	334 (45%)

SSB, sugar-sweetened beverage

Following adjustment for age, race/ethnicity, per capita income, education level, political affiliation, and survey mode, the odds of reporting lowered SSB consumption due to the SSB tax were 3.12 times higher (95% Confidence Interval: 1.92, 5.07) for participants who were exposed to negative messaging about the tax compared to those not exposed to negative messaging (**Table 2**). The odds of reporting lowered SSB consumption did not significantly differ between participants exposed to positive messaging and those not exposed (Odds Ratio: 0.60; 95% CI: 0.35, 1.03). A test looking at overall exposure to messaging (positive or negative) showed that the relationship between exposure to messaging and reporting lowered SSB consumption due to the tax is statistically significant (p-value <0.01).

Table 2. Odds of reporting lowered consumption of SSBs due to SSB tax, by messaging exposure type

Messaging exposure type	OR (95% CI)
Positive Exposure	
No	ref
Yes	0.60 (0.35, 1.03)
Negative Exposure	
No	ref
Yes	3.12 (1.92, 5.07)

SSB, sugar-sweetened beverage; OR, odds ratio; CI, confidence interval; ref, reference group. Adjusted for age, race/ethnicity, per capita income, education level, political affiliation, and survey mode. Robust standard errors were used to calculate confidence intervals.

There was no evidence that the association between exposure to messaging about the tax and reporting lowered SSB consumption due to the tax was modified by education level for either negative exposure (p-value: 0.6) or positive exposure (p-value: 0.5). Additionally, there was no evidence that the association was modified by political affiliation for either negative exposure (p-value: 0.8) or positive exposure (p-value: 0.9).

Similar to the results described above, sensitivity analyses showed that the odds of reporting lowered SSB consumption significantly differed between participants exposed to negative messaging and those not exposed to any messaging (OR: 3.40; 95% CI: 2.02, 5.70), while the relationship was not significant for exposure to positive messaging (OR: 0.95; 95% CI: 0.31, 2.90) or exposure to both messaging types (OR: 1.83; 95% CI: 0.999, 3.36). A test looking at overall exposure to messaging (positive, negative, or both) showed that the relationship is statistically significant (p-value <0.01). Additionally, there was no evidence that the association between exposure to messaging about the tax and reporting lowered SSB consumption due to the tax was modified by education level or political affiliation for either negative exposure or positive exposure.

DISCUSSION

Previous research has shown that how SSB taxes are presented is vital to public acceptance of such taxes, and support for SSB taxes is higher when framed as a measure to prevent obesity, and when tax revenue will be used for health programs.^{19,23} We hypothesized that the importance of positive messaging and framing of SSB taxes would extend past implementation of the tax to contribute to the success of the tax in terms of lowering consumption of SSBs. However, among the group of Seattle residents surveyed in this study, exposure to negative messaging about the Seattle SSB tax was much greater than exposure to positive messaging. Additionally, those exposed to negative messaging about the tax had higher odds of reporting lower SSB consumption due to the SSB tax than those who reported no exposure to negative messaging. The association between any exposure to messaging (negative or positive) and lowering SSB consumption due to the tax is significant.

These results suggest that the relationship between messaging and success of SSB taxes may differ prior to and following implementation of the tax. Prior to implementation, positive framing of SSB taxes is an integral part of gaining acceptance and enacting such taxes.^{21,22} Contrary to these previous findings, the results of this analysis provide evidence that after a SSB tax has been implemented, the nature of messaging about the tax may be less important in terms of lowering consumption. Following the enactment of the Seattle SSB tax,

supporters of the tax cited the tax's success in raising revenue for healthy food access and child health programs.²⁴ Meanwhile, opponents of the tax began a heavily funded campaign to prevent additional local taxes on groceries with an initiative nicknamed "Yes to Affordable Groceries."²⁵ The large financial support behind campaigns against the SSB tax and similar legislature may in part explain the high reported exposure to negative messaging about the tax among participants of this study.

The results of this analysis suggest that for SSB taxes to be successful in lowering SSB consumption, discourse and messaging about the tax may be an important factor. However, it may be less important whether that messaging supports or opposes the tax. Future research should work to confirm the relationship between tax related messaging and lowered SSB consumption due to SSB taxes, following tax implementation. The increase in implementation of similar SSB policies across the US provides an opportunity to study this association in other cities and jurisdictions.

Limitations

One potential explanation for why study participants reported exposure to negative messaging at a much higher rate than exposure to positive messaging is negativity bias. This bias results in a tendency to remember negative events and experiences more intensely than positive ones.²⁷ When participants were asked to recall whether they had seen or heard anything positive or negative about the tax in the past six months, they may have been more likely to remember negative messaging about the tax than positive messaging. Another explanation for the high reported exposure to negative messaging is possible misinterpretation of the survey question. If participants thought the questions were asking about SSBs in general, not the tax, it is more likely that they would report seeing negative messaging about the negative health effects about soda and sugary drinks than positive messaging such as advertisement for sugary drinks. As we do not have additional information about what messaging participants saw, we cannot confirm their interpretation of the questions.

There are several additional limitations to this study. First, the data is cross-sectional, which prevents us from observing a temporal relationship between the exposure and outcome. Second, the data is self-reported and may be subject to recall bias. If participants were exposed to messaging about the tax in the six months prior to survey completion but didn't remember hearing about the tax, it could have resulted in misclassification of the exposure. The data is also subject to social desirability bias, especially for participants of the phone version of the survey. In analysis of a related survey conducted prior to implementation of the tax, phone

respondents were found to under-report SSB consumption and over-report beliefs about the positive health and economic impacts of the SSB tax compared to those who took the survey online.²⁸ A higher proportion of participants in the current study completed the online survey, limiting the impact of social desirability bias. Additionally, all models included adjustment for survey mode to further limit this bias.

Finally, the survey was conducted a year and a half after the Seattle SSB tax was enacted, but the survey only asks about consumption in the last year and exposure to tax messaging in the last six months. Therefore, with this data we do not capture the immediate impact of the tax on SSB consumption, and messaging about the tax may have been lower at the time of the survey than immediately following implementation of the tax. Lower levels of messaging about the tax at the time of the survey may have contributed to lower levels of reported exposure to positive messaging and resulted in the positive exposure variable being underpowered. This could explain why there appears to be a relationship between exposure to positive messaging and lowering SSB consumption due to the tax, but it did not reach statistical significance.

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