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Short Communication

No long-term store marketing changes following sugar-sweetened beverage tax implementation: Oakland, California

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ABSTRACT

Globally, more than 45 countries have implemented sugar-sweetened beverage (SSB) taxes; however, little is known about effects on marketing practices. For the 2017 Oakland, California, 1 cent per ounce SSB tax, this study evaluated long-term changes in beverage price promotions, depth of sale, and interior and exterior advertising at stores, collected via in-person audits at two time points (pre-tax and 24-months post-tax). Overall, based on difference-in-differences estimation, relative to the comparison site, no significant pre-post tax changes were found in the odds of price promotions, exterior or interior advertising, or sale depth for SSBs or untaxed beverages. As additional SSB taxes are considered these findings suggest that SSB taxes may not have long-term effects on store marketing practices.

1. Introduction

Sugar-sweetened beverage (SSB) consumption is associated with obesity, type 2 diabetes, and hypertension as well as cardiovascular and all-cause mortality (Malik and Hu, 2019; Malik et al., 2019; Qin et al., 2020). Tax policy is a tool proposed to reduce SSB overconsumption and related health risks, and earmarking SSB tax revenue to fund public health and equity programs may lead to further improvements in population health (International Diabetes Federation, 2016; Jacobson et al., 2018; World Cancer Research Fund International, 2018). The premise of SSB tax policy is that taxes will raise consumer-faced SSB prices and, in turn, lower SSB consumption. Currently, more than 45 countries have implemented SSB taxes of varying magnitudes, which international evidence suggests are effective in reaching these goals (World Bank, 2020). Utilizing real-world evaluations, a tax raising prices by 10% is associated with a 10% decline in consumption (Teng et al., 2019; World Bank, 2020). A recent simulation study found taxes increasing prices by 20% could result in a global gain of 24.3 million additional life years over 50 years (Summan et al., 2020). An assessment of 187 countries ranked the United States (U.S.) 26th highest in average SSB consumption (Singh et al., 2015). In the U.S., SSB taxes are in place in seven local-level jurisdictions (ChangeLab Solutions, Healthy Food America, 2018).

Studies evaluating SSB tax impacts include a focus on intermediary outcomes, such as changes in SSB prices in retail outlets (or tax pass-through) (Cawley et al., 2019), which is a primary mechanism through which taxes affect purchasing and ultimately consumption. Another mechanism impacting consumer behavior may be changes in store marketing practices, where firms (i.e., retailers, distributors, manufacturers) may alter marketing practices such as beverage price promotions (i.e., temporary price discounts) and advertising (i.e., promotional signage). Increased marketing practices may strengthen consumer demand for SSBs. Conversely, marketing practices may be decreased, specifically SSB price promotions, to protect revenue. Similarly, shifts in store marketing practices may be observed for untaxed products, such as artificially sweetened beverages (ASBs) and unsweetened beverages (USBs), to encourage substitution from one product to another. Recent evidence reports partial (61%) to almost complete (92%) tax pass-through of the 1 cent per ounce Oakland, California, SSB excise tax, implemented in July 2017, to taxed beverages and a slight increase in the price of untaxed beverages with variations in pass-through by store type and beverage type and size (Cawley et al., 2020; Falbe et al., 2020). A qualitative study in taxed California cities (Oakland, Berkeley, San Francisco) reported 28% of retailers raised the price of at least one untaxed beverage post-tax implementation (Ponce

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et al., 2020).

Previously, pre-post tax changes to store marketing practices for taxed SSBs and untaxed beverages were evaluated for the Oakland SSB tax; specifically, price promotions and interior and exterior advertising (Zenk et al., 2020). Study findings revealed the prevalence of price promotions for SSBs, especially regular soda, and ASBs fell in Oakland relative to the comparison site at 6-months post-tax implementation; reductions for regular soda and ASBs persisted at 12-months post-tax. No significant pre-post tax changes in Oakland relative to the comparison site were found for interior or exterior SSB or ASB advertising. To our knowledge, no other study has examined pre-post tax changes in store marketing practices. This analysis evaluates long-term changes in store marketing practices two-years (24-months) post-tax implementation and extends the analysis to assess whether sale depth (i.e., extent of difference between regular and sale price) changed beyond changes in the prevalence of price promotions.

2. Methods

This study evaluated the impact of the Oakland SSB tax on store marketing practices using Sacramento, California, as a comparison site and a difference-in-differences (DID) estimation approach. Marketing data were collected through in-person store audits at two time points: pre-tax implementation in May–June 2017 and two-years post-tax implementation in June 2019. Across these two time points, a total of 478 audits were conducted in 129 stores in Oakland and 124 stores in Sacramento.

Price promotions were measured based on a review of signage, shelf tags, and advertisements for 59 specific taxed SSB products, 37 specific untaxed ASB products, and 32 untaxed USB products. A product was considered price promoted if it was on sale or had a discounted price (e.g., reduced price per quantity, buy 1 get 1 free). For SSBs and ASBs, selected products within each type (i.e., soda, sports drink, energy drink, ready-to-drink coffees/tea, juice drink) included a range of varieties (e.g., cola and orange), manufacturers, and package sizes. For USB types (i.e., milk, bottled and sparkling water, 100% juice, unsweetened ready-to-drink coffee/tea), selected products included multiple package sizes and manufacturers. The analysis used binary product-level variables for whether or not the product was on sale.

Sale depth, conditional on product sale, was calculated for each product as the difference between the audit-recorded regular price and sale price. Only reduced-price and reduced-price-per-quantity promotions were considered in computing sale depth. Sale depth was included in the analysis as a continuous variable (cents per ounce).

Advertising was measured for 4 taxed SSB types (regular or calorically sweetened soda, sports drinks and energy drinks, and juice drinks), 3 untaxed ASB types (diet or zero-calorie soda, sports drinks, and energy drinks), and 3 untaxed USB types (plain bottled water, milk, and 100% fruit juice). Exterior advertisements included signs, posters, flags, decals, stickers, marquees, and sandwich boards on the building exterior and property. Interior advertising, located within the store, included end-aisle displays and special floor displays (e.g., stacked products, racks, tables, and other temporary shelving around which customers must navigate). For this analysis, separate variables were constructed for exterior and interior advertising at the store level. Binary variables were derived for whether or not any SSB, any ASB, and any USB advertising was present. In addition, we developed binary variables for each of the 4 assessed SSB subtypes.

Covariates included store type [chain and non-chain limited service stores (convenience, small discount, and pharmacy) versus supermarkets (also included general merchandise and grocery)], census tract racial/ethnic composition (majority non-Hispanic white versus other), and census tract median household income. Census tract-level data were from American Community Survey 5-year estimates (US Census Bureau, 2016). Price promotion and sale depth analyses also controlled for beverage type and package size [individual-sized ($\leq$1 L) versus family-sized (>1 L or multipack)].

Descriptive statistics were estimated for each site and timepoint. DID regressions with robust standard errors clustered on store estimated pre-post changes in each beverage marketing outcome in Oakland, adjusting for changes in the comparison site. Logistic models were estimated for price promotions, exterior advertising, and interior advertising. Linear models were estimated for sale depth. Each model included site (Oakland versus Sacramento), timepoint (24 months versus baseline), site by timepoint interaction term, and covariates. Here, we report only the DID estimates (i.e., site by timepoint interaction terms), which show whether changes over time in Oakland marketing outcomes were significantly different from changes over time in Sacramento. In the logistic models, the exponentiated DID estimates correspond to ratios of odds ratios (RORs). Analytic samples were balanced to only include observations where data on the specific product-level measure (for price promotions and sale depth) or specific advertising measure were available at a given store at baseline and two-years post-tax. After balancing, which accounted for missing data, the analytic samples included: 14,854 product observations from 105 stores in Oakland and 119 in Sacramento for price promotions; 2092 product observations from 25 stores in Oakland and 61 in Sacramento for sale depth; and 438-450 store observations from 101 to 106 stores in Oakland and 118–119 in Sacramento for exterior and interior advertising. We estimated models for overall SSBs, ASBs, and USBs, as well as SSBs by beverage and store type. Product-level analyses were weighted by distribution of volume sold by beverage type, sweetener status (SSB, ASB, or USB), and size in both sites (Oakland and Sacramento) and two-mile buffers around them from June 2016–May 2017, computed from Nielsen data. Analyses were conducted in Stata/SE 15.1.

More details on the methods can be found elsewhere (Li et al., 2018, Zenk et al., 2020).

3. Results

Table 1 shows the prevalence of price promotions and mean sale depth in Oakland and Sacramento at baseline and two-years post-tax. For example, in Oakland at baseline, 36.7% of SSB products were price promoted, with 51.9% and 21.7% of SSB products price promoted in supermarkets and limited service stores, respectively. In Oakland at baseline, the mean sale depth was 1.82 cents per ounce for SSBs, 1.83 cents per ounce for ASBs, and 0.97 cents per ounce for USBs. Table 2 shows the prevalence of exterior and interior advertising in Oakland and Sacramento at baseline and two-years post-tax. For example, in Oakland at baseline, 31.4% of stores had exterior SSB advertising, with a similar prevalence at supermarkets (29.0%) and limited service stores (32.4%). The prevalence of interior SSB advertising was twice as high at 66.0%, which included 72.7% of supermarkets and 63.0% of limited service stores.

Table 3 presents the DID regression results for two-year changes in price promotions, sale depth, exterior advertising, and interior advertising. The results for price promotions reveal no significant changes in the odds of price promotions in Oakland relative to Sacramento for SSBs overall (ROR = 0.97, 95% CI = 0.65,1.44), ASBs (ROR = 0.84, 95% CI 0.47,1.49), or USBs (ROR = 1.33, 95% CI = 0.67,2.67). By SSB beverage type, the odds of price promotions for energy drinks increased at two-years post-tax in Oakland relative to Sacramento (ROR = 1.78, 95% CI = 1.12,2.82), whereas the odds of price promotions for ready-to-drink coffee/tea decreased at two-years post-tax in Oakland relative to Sacramento (ROR = 0.43, 95% CI = 0.21,0.87).

For sale depth (Table 3), pre-post tax changes did not differ significantly between Oakland and Sacramento for SSBs overall (coefficient = 0.13, 95% CI = -0.13,0.39), ASBs (coefficient = -0.18, 95% CI = -0.46,0.11), or USBs (coefficient = 0.23, 95% CI = -0.05,0.51).

For exterior advertising and interior advertising (Table 3), no significant changes were found in Oakland relative to Sacramento for SSBs (including by beverage type and store type), ASBs, or USBs.

Table 1
Prevalence of price promotions and mean sale depth in Oakland, California, and Sacramento, California, at baseline and two-years post-tax, 2017–2019.

	Price Promotions				Sale Depth (cents per ounce)			
	Oakland Baseline	Oakland Post-Tax	Sacramento Baseline	Sacramento Post-Tax	Oakland Baseline	Oakland Post-Tax	Sacramento Baseline	Sacramento Post-Tax
SSBs (N = 1536, 1536, 2469, 2469, 188, 188, 401, 401)	36.7%	29.1%	41.2%	33.3%	1.82	1.86	1.75	1.67
SSBs By Beverage Type								
Soda (N = 689, 689, 1143, 1143, 48, 48, 157, 157)	34.2%	27.6%	38.3%	30.4%	1.24	1.03	1.37	1.25
Sports drinks (N = 273, 273, 375, 375, 53, 53, 100, 100)	41.1%	30.1%	54.3%	46.9%	2.57	2.49	2.21	2.15
Energy drinks (N = 333, 333, 553, 553, 54, 54, 77, 77)	30.3%	28.2%	40.1%	25.4%	4.13	4.52	4.22	4.23
Ready-to-drink coffee/tea (N = 167, 167, 296, 296, 18, 18, 52, 52)	38.8%	26.3%	32.7%	37.9%	2.03	1.24	2.95	2.45
Juice drinks (N = 74, 74, 102, 102, 15, 15, 15, 15)	38.3%	31.5%	43.0%	31.0%	1.56	1.99	1.32	1.56
SSBs By Store Type								
Supermarket (N = 573, 573, 993, 993, 97, 97, 243, 243)	51.9%	40.5%	49.3%	45.3%	1.45	1.65	1.60	1.50
Limited service store (N = 963, 963, 1476, 1476, 91, 91, 158, 158)	21.7%	17.7%	32.3%	19.9%	2.63	2.33	2.12	2.07
ASBs (N = 653, 653, 1274, 1274, 110, 110, 249, 249)	46.1%	37.7%	45.1%	40.6%	1.83	1.56	1.70	1.60
USBs (N = 561, 561, 934, 934, 39, 39, 59, 59)	13.4%	14.7%	13.2%	11.5%	0.97	0.98	0.97	0.75

Sample sizes (numbers of product-level observations) for the estimates in each row are shown separated by commas. Estimates are weighted based on the distribution of volume sold by beverage type, sweetener status (SSB, ASB, or USB), and size in Oakland, Sacramento, and two-mile buffers around both sites from June 2016–May 2017. Supermarkets also include grocery stores and general merchandise stores. Limited service stores include convenience stores, small discount stores, and pharmacies. The analytical sample for price promotions included observations from 105 stores in Oakland (including 32 supermarkets and 73 limited service stores) and 119 stores in Sacramento (including 37 supermarkets and 82 limited service stores). The analytical sample for sale depth included observations from 25 stores in Oakland (including 9 supermarkets and 16 limited service stores) and 61 stores in Sacramento (including 26 supermarkets and 35 limited service stores).
ASB: artificially sweetened beverage, SSB: sugar-sweetened beverage, USB: unsweetened beverage.

Table 2
Prevalence of exterior and interior advertising in Oakland, California, and Sacramento, California, at baseline and two-years post-tax, 2017–2019.

	Exterior Advertising				Interior Advertising			
	Oakland Baseline	Oakland Post-Tax	Sacramento Baseline	Sacramento Post-Tax	Oakland Baseline	Oakland Post-Tax	Sacramento Baseline	Sacramento Post-Tax
SSBs (N = 102, 102, 118, 118, 106, 106, 119, 119)	31.4%	24.5%	37.3%	33.1%	66.0%	55.7%	91.6%	84.0%
SSBs By Beverage Type								
Soda (N = 101, 101, 118, 118, 106, 106, 118, 118)	22.8%	18.8%	28.8%	28.0%	57.5%	47.2%	86.4%	72.0%
Sports drinks (N = 101, 101, 118, 118, 105, 105, 118, 118)	5.0%	7.9%	11.0%	17.8%	24.8%	23.8%	56.8%	49.2%
Energy drinks (N = 101, 101, 118, 118, 104, 104, 119, 119)	15.8%	12.9%	22.0%	22.9%	24.0%	27.9%	65.5%	63.9%
Juice drinks (N = 102, 102, 118, 118, 106, 106, 119, 119)	5.9%	0.0%	4.2%	2.5%	34.0%	29.2%	59.7%	47.9%
SSBs By Store Type								
Supermarket (N = 31, 31, 37, 37, 33, 33, 37, 37)	29.0%	12.9%	18.9%	10.8%	72.7%	78.8%	94.6%	91.9%
Limited service store (N = 71, 71, 81, 81, 73, 73, 82, 82)	32.4%	29.6%	45.7%	43.2%	63.0%	45.2%	90.2%	80.5%
ASBs (N = 101, 101, 118, 118, 106, 106, 118, 118)	4.0%	10.9%	14.4%	16.1%	45.3%	45.3%	74.6%	79.7%
USBs (N = 103, 103, 118, 118, 106, 106, 118, 118)	16.5%	10.7%	16.1%	16.1%	50.9%	47.2%	77.1%	79.7%

Sample sizes (numbers of stores) for the estimates in each row are shown separated by commas. Supermarkets also include grocery stores and general merchandise stores. Limited service stores include convenience stores, small discount stores, and pharmacies. The analytical samples for exterior and interior advertising included a total of 106 stores in Oakland (including 33 supermarkets and 73 limited service stores) and 119 stores in Sacramento (including 37 supermarkets and 82 limited service stores).
ASB: artificially sweetened beverage, SSB: sugar-sweetened beverage, USB: unsweetened beverage.

4. Discussion

This study provides new evidence on long-term (two-year) changes in store beverage marketing practices following the 2017 Oakland SSB tax implementation. We previously reported short-term (at 6- and 12-months post-tax) reductions in the prevalence of price promotions for

Table 3
Difference-in-differences estimates of two-year changes in price promotions, sale depth, and exterior and interior advertising in Oakland, California, relative to Sacramento, California, 2017–2019.

	Price Promotions	Sale Depth (cents per ounce)	Advertising	
	ROR (95% CI)	Coefficient (95% CI)	Exterior ROR (95% CI)	Interior ROR (95% CI)
SSBs (N = 8010, 1178, 440, 450)	0.97 (0.65,1.44)	0.13 (-0.13,0.39)	0.84 (0.48,1.47)	1.33 (0.66,2.68)
SSBs By Beverage Type				
Soda (N = 3664, 410, 438, 448)	1.03 (0.61,1.76)	-0.08 (-0.38,0.21)	0.81 (0.44,1.49)	1.64 (0.85,3.15)
Sports drinks (N = 1296, 306, 438, 446)	0.80 (0.44,1.45)	-0.02 (-0.37,0.34)	0.92 (0.31,2.75)	1.31 (0.67,2.58)
Energy drinks (N = 1772, 262, 438, 446)	**1.78*** **(1.12,2.82)**	0.37 (-0.33,1.08)	0.72 (0.33,1.57)	1.32 (0.67,2.60)
Ready-to-drink coffee/tea (N = 926, 140, NA, NA)	**0.43*** **(0.21,0.87)**	-0.29 (-0.88,0.31)	–	–
Juice drinks (N = 352, 60, NA, 450)	1.18 (0.49,2.80)	0.19 (-0.60,0.98)	NC	1.35 (0.65,2.79)
SSBs By Store Type				
Supermarkets (N = 3132, 680, 136, 140)	0.67 (0.36,1.27)	0.29 (-0.02,0.60)	0.67 (0.17,2.59)	2.17 (0.42,11.19)
Limited service stores (N = 4878, 498, 304, 310)	1.49 (0.92,2.43)	-0.24 (-0.56,0.08)	0.96 (0.53,1.75)	1.09 (0.49,2.39)
ASBs (N = 3854, 718, 438, 448)	0.84 (0.47,1.49)	-0.18 (-0.46,0.11)	2.72 (0.64,11.56)	0.74 (0.39,1.40)
USBs (N = 2990, 196, 442, 448)	1.33 (0.67,2.67)	0.23 (-0.05,0.51)	0.59 (0.24,1.43)	0.73 (0.39,1.35)

Each cell shows the difference-in-differences estimate from a separate model. Logistic regression was used for price promotions and advertising, and linear regression was used for sale depth. Store-level models for advertising controlled for store type and census tract-level median household income and race/ethnicity. Product-level models for price promotions and sale depth additionally controlled for beverage type and size. Robust standard errors were computed for all models, clustered on store. Product-level models were weighted based on the distribution of volume sold by beverage type, sweetener status (SSB, ASB, or USB), and size in Oakland, Sacramento, and two-mile buffers around both sites from June 2016–May 2017. The model for exterior advertising for juice drinks could not be computed because no stores in Oakland had such marketing post-tax, and data were not collected on advertising of ready-to-drink coffee/tea. Supermarkets also include grocery stores and general merchandise stores. Limited service stores include convenience stores, small discount stores, and pharmacies.
ASB: artificially sweetened beverage, NA: not applicable, SSB: sugar-sweetened beverage, USB: unsweetened beverage, ROR: ratio of odds ratios, NC: not computed (model could not be computed).
Statistically significant estimates are in bold (*p < .05; **p < .01).

SSBs overall, regular soda, and ASBs in Oakland relative to Sacramento (Zenk et al., 2020), which implied firms may have reduced price promotions to offset revenue losses. The current findings show that these changes disappeared by two-years post-tax implementation. However, at two-years post-tax, the prevalence of price promotions increased for regular energy drinks and decreased for ready-to-drink coffee/tea. No significant differences in price promotions were observed in these two products at 6- or 12-months post-tax (Zenk et al., 2020). With respect to the depth of SSB price promotions, no significant changes were found at two-years post-tax.

Price promotions are known to influence purchasing (Watt et al., 2020), and energy-dense, nutrient-poor food and beverage products are more likely to be price promoted than healthy products (Bennett et al., 2020; Riesenberg et al., 2019; Kaur et al., 2020). In particular, SSBs are among the most frequently price-promoted products (Powell et al., 2016; Zorbas et al., 2019). As such, regulating SSB price promotions is gaining attention in multiple countries and locales as a potential strategy to improve population health (Huse et al., 2020; Kaur et al., 2020). An Australian modeling study estimated mandatory restrictions of SSB price promotions would gain 34,260 total health-adjusted life years and save AUD376 million in healthcare costs (Huse et al., 2020). Our short-term Oakland SSB tax results suggested reductions in SSB price promotions may be a positive unintended consequence of SSB taxes and a possible contributor to the observed price increases experienced by consumers (Zenk et al., 2020; Cawley et al., 2020; Falbe et al., 2020). But, as shown here, this finding did not persist in the longer-term. Thus, complementary regulation of SSB price promotions could further reduce SSB purchasing. Research to evaluate joint effects of SSB taxes and SSB price promotion regulations on purchasing and ultimately consumption and health is needed.

Our study's limitations include: 1) the data are limited based on sample sizes particularly for some analyses by store type or beverage type; only include two timepoints and do not include pre-tax marketing trends; and cannot differentiate between the marketing practices of retailers, distributors, and manufacturers; 2) we cannot control for the possibility of other interventions or changes in policies or programs in the post-tax period; and, 3) because our analysis is based on one city's tax, the generalizability of the results is unknown. Nonetheless, the study elucidates store marketing practices two years after implementation of a SSB tax, and reveals few pre-post tax changes. As countries and locales consider SSB taxes and seek to understand their impact, our findings from Oakland, California, suggest that SSB taxes may not impact store marketing practices long-term.

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