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RESEARCH ARTICLE

A Sugar-Sweetened Beverage Excise Tax in California: Projected Benefits for Population Obesity and Health Equity

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Introduction: Amid the successes of local sugar-sweetened beverage (SSB) taxes, interest in statewide policies has grown. This study evaluated the cost effectiveness of a hypothetical 2-cent-per-ounce excise tax in California and its implications for population health and health equity.

Methods: Using the Childhood Obesity Intervention Cost-Effectiveness Study microsimulation model, tax impacts on health, health equity, and cost effectiveness over 10 years in California were projected, both overall and stratified by race/ethnicity and income. Expanding on previous models, differences in the effect of intake of SSBs on weight by BMI category were incorporated. Costing was performed in 2020, and analyses were conducted in 2021−2022.

Results: The tax is projected to save $4.55 billion in healthcare costs, prevent 266,000 obesity cases in 2032, and gain 114,000 quality-adjusted life years. Cost-effectiveness metrics, including cost/quality-adjusted life year gained, were cost saving. Spending on SSBs was projected to decrease by $33 per adult and $26 per child overall in the first year. Reductions in obesity prevalence for Black and Hispanic Californians were 1.8 times larger than for White Californians, and reductions for adults with lowest incomes (<130% Federal Poverty Level) were 1.4 times the reduction among those with highest incomes (>350% Federal Poverty Level). The tax is projected to save $112 in obesity-related healthcare costs per $1 invested.

Conclusions: A state-wide SSB tax in California would be cost saving, lead to reductions in obesity and improvement in SSB-related health equity, and lead to overall improvements in population health. The policy would generate more than $1.6 billion in state tax revenue annually that can also be used to improve health equity.

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INTRODUCTION

Despite the adverse influence of sugar-sweetened beverages (SSBs) on health, consumption remains prevalent in California.[1] In 2021, residents purchased >3.6 billion liters of SSBs, representing approximately $320 million in transactions.[2] Consuming even 1−2 servings of SSBs daily is linked to higher cardiometabolic disease risk.[3] To encourage lower consumption of SSBs at a population level, 4 California cities, comprising Berkeley, San Francisco, Oakland, and

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Albany, have enacted excise taxes on the distribution of SSBs, which are passed through to consumers through increases in shelf prices. Strong evidence suggests that reductions in SSB intake lead to declines in obesity-related diseases, and thus, evaluations of SSB taxes have found that they lead to reductions in consumption and sales.[4−6]

Cost-effectiveness analyses of national taxes have projected that they can lead to substantial healthcare improvements and cost savings.[7] However, prior models have not established what an SSB tax's impact would be on health equity, despite the fact that consumption is patterned by race and class. For example, targeted marketing of SSBs to lower-income Black and Hispanic communities is clearly documented, including greater advertising spending on Spanish-language television and higher levels of beverage advertising on media consumed by Black adults and youth.[8] In a recent report, Coca-Cola and PepsiCo were responsible for the majority of campaigns directed at youth of color.[8] These forces are likely to further entrench disparities in SSB consumption. Despite calls for population interventions that also improve health equity,[9] few cost-effectiveness studies on SSB taxes report results by these demographic characteristics in ways to help inform public policy.[10] Previous models have also assumed that changes to SSB consumption result in equivalent changes to weight across the entire BMI distribution, despite the evidence that adults and children at higher BMI may be more sensitive to reductions in SSBs.[11−13] In this study, a microsimulation approach was used to estimate the 10-year cost effectiveness and health equity impacts of a $0.02/oz SSB excise tax implemented in California, accounting for differences in the impacts of SSB intake on weight by BMI.

METHODS

The Childhood Obesity Intervention Cost-Effectiveness Study (CHOICES) microsimulation model was used to project the costs, health impacts, and cost effectiveness of a $0.02/oz excise tax on SSBs in California from 2023 to 2032, compared with no intervention. A 10-year time horizon was chosen because of its relevance for policymaking and the likelihood that the impacts of a tax would be reasonably sustained over this period. *SSBs* were defined as any beverage with added caloric sweeteners. Diet beverages, 100% juices, and milk beverages were not considered taxed under the intervention, consistent with current policy.[14] This tax would be applied to all distributors in the state, and a $0.02/oz rate was chosen after discussions with local partners. This study was determined to be not human subjects research by the Harvard T H Chan School of Public Health IRB.

Study Population

A state-wide tax would reach all individuals aged ≥2 years over a 10-year intervention period in California. The CHOICES model simulates a state-representative open population through a nonparametric matching procedure that synthesizes data, including the U.S. 2010 Census tract data, the National Health and Nutrition Examination Survey (NHANES), and the American Community Survey, while ensuring that distributions of demographic variables are consistent with reported state-level data. Height/weight trajectories are drawn on the basis of pooled analyses of large prospective cohort studies. Population growth was stratified by sex, age, race/ethnicity, BMI category, and smoking status using data from the U.S. Population Projections, life tables, and NIH−American Association of Retired Persons Diet and Health Study.[7,15] Weight trajectories and demographics were calibrated to match state-level data from the California Health Interview Survey (2011−2017) by including the state-level prevalence estimates as calibration targets in the simulation.[16]

Following standard guidelines,[17] costs to state government and industry were determined assuming that the California Department of Tax and Fee Administration would be responsible for administering and auditing a tax (Table 1). Costing was previously performed in 2020 by Gouck et al. (2021).[18] State costs, including taxpayer identification, communications, and training, were identified by the California Department of Tax and Fee Administration and the California Department of Public Health. Industry costs included those related to tax submissions and auditing compliance. For the 1,065 distributors that would be subject to the tax, 0.022 full-time equivalent units from an industry accountant would be required per distributor.[19] Health-related costs were estimated on the basis of analyses of the Medical Expenditure Panel Survey, with continuous BMI-related costs by age and sex assigned on the basis of analyses from 2011 to 2016.[20] Prior microsimulations of taxes have assigned health-related costs using categorical definitions of weight, leading to loss of information compared with the use of approaches that reflect the nonlinear relationship between BMI and costs by assigning health-related costs for each BMI value.[20]

All costs were converted to 2019 U.S. dollars, the most recent year for which data were available at the time of economic analysis, and future costs were discounted at the standard rate of 3% per year to reflect the decaying value of future costs and benefits as recommended by the Second Panel on Cost-Effectiveness in Health and Medicine.[21] Results are reported from a modified societal perspective, which excludes costs associated with productivity changes, associated with obesity or patient

Table 1. Microsimulation Inputs and Sources for a $0.02-Per-Ounce California State-Wide SSB Excise Tax

Parameter	Value/distributional assumptions	Source/notes
Costs		
Administrative start-up (Year 1) costs for CDTFA	$1.8−2.5 million; sampled from uniform distribution with lower bound of $1.8million and upper bound of $2.5million	CDPH and CDTFA; includes lump cost related to taxpayer identification, notification, and registration; regulation development; manual and publication revisions; tax return design; computer programming; return, payment, and refund claim processing; audit and collection tasks; staff training; and public inquiry responses
Ongoing annual costs (years 2−10) for CDTFA	$1.4−2 million; sampled from uniform distribution with a lower bound of $1.4 million and upper bound of $2 million	Same as administrative start-up costs.
Number of SSB distributors	1,065 (fixed)	CDPH/CDTFA
Labor (in FTEs) for industry tax submission and compliance	23 FTE total (range from 8.2 to 37.4), 0.0216 FTE per distributor (range from 0.0077 to 0.0351); sampled from PERT distribution with a minimum of 0.0077, most likely 0.0216, and a maximum of 0.0351	Based on previous estimates of accountant labor from microsimulations of other SSB taxes by CHOICES.
Annual salary for industry accountants	$83,910 (fixed) with a 43.65% fringe benefits rate	BLS; fringe rate based on the national average for private industry workers in 2019
Effects		
Baseline daily intake of SSBs	Model based	Assigned on the basis of nonparametric statistical matching in microsimulation population initialization, from NHANES 2011−2016 24-hour dietary recall data, sampled conditional on sex, age, poverty level, race/ethnicity, weight, and height
SSBs baseline price per ounce ($)	0.0881 (fixed)	Based on 2020 estimated beverage sales by category in California from the UConn Rudd Center Sugary Tax Calculator and the price for different beverage categories (inflated to 2020 dollars) from Powell et al.[38]
Own-price elasticity of demand for SSBs	−1.22 (range from −2.63 to −0.70); sampled from shifted exponential distribution with lambda 1.9044 and shift parameter 0.6892	Systematic review/pooled analysis of 12 studies reporting elasticities of demand for various SSBs by Powell et al. (2013)[26] Shifted exponential prior distribution chosen on the basis of previous goodness of fit analyses by Long et al. (2015)[14]
Δ in SSB intake to Δ in weight (youth aged 2−19 years, above age- and sex-specific median)	1.53 kg over 18 months for 8.4oz daily replacement of artificially sweetened for sugar-sweetened beverages; sampled from normal distribution with a mean of 1.53 and SD of 0.42	From a randomized trial of Dutch primary school children by Katan et al. (2016)[11] Dutch Median BMI for children by age and sex and additional details available in the Appendix (available online)
Δ in SSB intake to Δ in weight (youth aged 2−19 years, below age- and sex-specific median)	0.62 kg over 18 months for 8.4oz daily replacement of artificially sweetened for sugar-sweetened beverages; sampled from normal distribution with a mean of 0.62 and SD of 0.32	From a randomized trial of Dutch primary school children by Katan et al. (2016)[11] Dutch Median BMI for children by age- and sex and additional details available in the Appendix.
Δ in SSB intake to Δ in weight (adults aged ≥20 years), overall	0.39 kg/m^2 for each additional 12-oz serving (range=0.21−0.57); sampled from uniform with a lower bound of 0.21 and upper bound of 0.57	Range of estimates taken from 4 change-in-change prospective cohort studies. Details on estimate extraction are available in Long et al. (2015) and in the Appendix (available online) technical details document.[14]
Effect scalar by BMI weight category for adults	Underweight/normal weight=0.494, overweight=1.056, obesity/severe obesity=1.625; sampled from uniform distributions; see technical details document in the Appendix (available online) for distributional parameters	Calculated from a meta-analysis of longitudinal cohort studies by Pan et al. (2013).[12] See technical details document in the Appendix (available online) for additional details. These scalars are multiplied by the overall adult Δ in SSB intake to Δ in weight effect for the final intervention effect.

BLS, Bureau of Labor Statistics; CDPH, California Department of Public Health; CDTFA, California Department of Tax and Fee Administration; CHOICES, Childhood Obesity Intervention Cost-Effectiveness Study; FTE, full-time equivalent; NHANES, National Health and Nutrition Examination Survey; PERT, Program Evaluation and Review Technique; SSB, sugar-sweetened beverage.

costs for transportation, or associated with the value of time seeking and receiving care—costs that are difficult to estimate and likely to be small over a 10-year time horizon.[7] Tax revenues and decreases in distributor SSB sales were not included in cost-effectiveness calculations, consistent with the standard guidelines.[22]

The impact of a tax followed the logic outlined in Appendix Figure 1 (available online), which relates changes in price to changes in individual purchases/consumption and weight. To estimate baseline SSB intake by sex, age, and race/ethnicity, state-specific questionnaire data from California Health Interview Survey (2011−2017), 24-hour recall data from NHANES (2011−2016), and sales data from the UConn Rudd Center for Food Policy and Health Sugary Drink Tax Calculator were combined.[23−25] Baseline intake levels for each age and race/ethnicity group were calibrated to their relative levels in California Health Interview Survey by applying scalars to the NHANES estimates, which provided information on all SSBs consumed in a 24-hour window by sex, age, and race/ethnicity. They were then scaled to match regional sales estimates from the UConn Rudd Center for Food Policy and Health.[25]

Implementation of a tax that increases SSB prices results in decreased consumption.[4] Assuming a tax would be fully passed on to consumers, an increase of $0.02/oz was calculated to translate to a 22.7% increase in the price of SSBs. Using an estimate of own-price elasticity of demand for SSBs of −1.21 identified from a systematic review of U.S. food prices,[26] price changes were translated to consumption changes, which were then converted into weight changes. On the basis of evidence indicating that the effect of SSB reduction on body weight differs by BMI,[11−13] model effect inputs for the SSB intake−associated BMI/weight change were stratified by individual weight classification. Technical details are provided in Appendix material (available online).

Measures

Intervention-attributable impacts over a 10-year period were projected after a California $0.02/oz SSB excise tax was implemented in 2023. These included the number of individuals reached by a tax, total implementation costs, and total healthcare costs saved over 10 years; changes in SSB spending, obesity prevalence, and quality-adjusted life years (QALYs); deaths averted and years with obesity prevented; and cost-effectiveness measures, including implementation costs per QALY gained, cost per year of obesity prevented, and healthcare costs saved per each $1 invested in implementation. Details on QALY weights by age, sex, and weight are found online (https://choicesproject.org/methods/choices-model-technical-documentation/). Following standard guidelines, values of cost effectiveness are not reported if an intervention is cost saving with respect to a given metric. Projected changes in the SSB intake were also examined because this is a proximal mechanism through which SSB taxes might lead to obesity reductions.[3] In addition, changes in per capita SSB spending in the first year were calculated. To assess tax impacts on health disparities, results were stratified by race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, or other racial/ethnic identities [including American Indian and Alaskan Native, Native Hawaiian and Other Pacific Islander, and those reporting multiple racial/ethnic identities]) and income as a percentage of the Federal Poverty Level (FPL) (<130%, 130%−185%, 185%−350%, and >350%). Relative reductions in obesity prevalence and SSB consumption for each group compared with a reference group (non-Hispanic White or above 350% FPL) were estimated.

Statistical Analysis

Estimates of the reach, costs, and effects of the intervention described earlier were used as inputs to the CHOICES microsimulation model. The CHOICES model is a stochastic, discrete-time individual-based model that projects obesity-related outcomes under intervention-absent and intervention-present scenarios. A total of 95% uncertainty intervals (UIs) for all outcomes were taken as the 2.5th and 97.5th quantiles of estimates across 1,000 Monte Carlo simulations. Additional details and updates on the CHOICES microsimulation are available online (https://choicesproject.org/methods/choices-model-technical-documentation/). Probabilistic sensitivity analyses were performed by drawing key input parameters from probability distributions (Table 1) and by stochastically sampling individuals to form the underlying simulated population. The primary model incorporated differential intervention effects by baseline BMI and applied healthcare costs by continuous values of BMI. However, several 1-way sensitivity models were conducted varying assumptions about the relationship between SSB intake and weight change, the assignment of healthcare costs, the tax rate, and the extent to which a tax would be passed through to consumers. Results from these are provided in Appendix material (available online, Appendix Table 1 and Appendix Table 2).

RESULTS

A $0.02/oz SSB tax would be expected to reach 43.3 million individuals (95% UI=42.9, 43.7) and cost $0.93 per person to implement (95% UI=0.67, 1.21) over 10 years (Table 2). In the first year, SSB spending, including dollars spent on the tax, would decrease by $32.54

Table 2. Impacts of a $0.02/oz SSB Excise Tax on Population Reach, Costs, and Health

Intervention impact measure	Impact estimate (95% UI)
Reach and cost measures	
10-year population reach (*n*, millions)	43.3 (42.9, 43.7)
10-year implementation costs ($, millions)	40.4 (29.1, 52.2)
10-year implementation costs per person ($)	0.93 (0.67, 1.21)
Healthcare costs saved over 10 years ($, billion)	4.55 (1.87, 10.60)
Net cost difference ($, billion)	−4.50 (−10.60, −1.84)
Healthcare costs saved per $1 invested ($)	112 (44, 279)
Health impact measures	
Mean per capita BMI reduction (kg/m^2)	−0.197 (−0.378, −0.097)
Reduction in obesity prevalence in 2032 (%)	0.678 (0.320, 1.370)
Reduction in childhood obesity prevalence in 2032 (%)	0.506 (0.213, 1.090)
Cases of obesity prevented in 2032 (n)	266,000 (125,000; 541,000)
Cases of childhood obesity prevented in 2032 (n)	42,700 (17,600; 92,300)
QALYs gained	114,000 (53,600; 239,000)
Years of life gained	21,700 (8,140; 52,900)
Deaths averted	6,320 (2,350; 15,000)
Years with obesity prevented (years, millions)	2.02 (0.958, 4.16)
Cost-effectiveness measures	
Cost per QALY gained	Cost saving
Cost per year with obesity prevented	Cost saving

SSB, sugar-sweetened beverage; QALY, quality-adjusted life year; UI, uncertainty interval.

(95% UI=$8.64, $140.78) for adults and by $25.67 (95%UI=$7.78, $123.92) for children.

From 2023 to 2032, a $0.02/oz California SSB tax would be cost saving across all cost-effectiveness metrics. It was projected to lead to $4.55 (95% UI=$1.87, $10.60) billion saved in healthcare costs with reductions in obesity prevalence and cases. Implementing a tax would prevent an estimated 266,000 (95% UI=125,000; 541,000) adult and 42,700 (95% UI=17,600; 92,300) childhood cases of obesity in 2032. A tax would also result in 114,000 (95% UI=53,600; 239,000) QALYs gained, 21,700 (95% UI=8,140; 52,900) years of life gained, 6,320 (95% UI=2,350; 15,000) deaths averted, and 2.02 (95% UI=0.958, 4.16) million years of obesity prevented. A tax would generate $112 (95% UI=44, 279) in health-related cost savings for each dollar invested in implementation (Table 2).

Differences in the projected impact of a tax varied by race/ethnicity and income (Table 3 and Figure 1). At baseline, SSB consumption was highest for non-Hispanic Black and Hispanic populations. These groups saw the largest reductions in consumption than the non-Hispanic White population, translating into greater relative reductions in obesity prevalence. Similarly, these populations were projected to experience the greatest reductions in per capita SSB spending in the first year (Appendix Table 3, available online). Because the impact of SSB reduction on weight is larger for individuals with higher BMI, these consumption differences were also amplified by co-occurring disparities in BMI. The tax-attributable obesity prevalence reductions among non-Hispanic Black and Hispanic populations were projected to be 1.82 times (95% UI=1.53, 2.27) and 1.75 (95% UI=1.47, 2.25) times the reduction among the non-Hispanic White group. This difference was larger for children: non-Hispanic Black children would experience an obesity prevalence reduction over twice as large (2.22, 95% UI=1.42, 3.07), and Hispanic children would experience a reduction of 1.88 (95% UI=1.48-2.49) as large as that of non-Hispanic White children. Subgroup analyses revealed an income gradient, with those in the lowest income category experiencing the largest relative reductions in projected obesity prevalence and SSB intake. Regardless of model specification, a state-wide tax was found to be cost saving over 10 years (Appendix Table 2, available online).

DISCUSSION

In this analysis, a $0.02/oz state-wide tax in California implemented in 2023 was projected to be cost saving over 10 years, with >260,000 cases of obesity among the population aged ≥2 years and >40,000 cases of childhood obesity averted in 2032 alone. This would result in $4.55 billion in related healthcare cost savings. Reductions in obesity prevalence were projected for all racial/ethnic and income groups. The largest benefits were projected among individuals who are non-Hispanic Black, individuals who are Hispanic, and individuals with lower incomes who would experience larger reductions in obesity prevalence, driven by greater reductions in SSB purchasing and intake than in other groups.

Results from this study were consistent with those of published cost-effectiveness analyses of national SSB taxes.[10,14] However, this study includes innovations that suggest that prior approaches may have underestimated the potential benefits of a tax. First, obesity-related healthcare costs were assigned using a novel continuous-

Table 3. Projected Reductions in Obesity and SSB Beverage Consumption After a Tax, by Race/Ethnicity and Income

Characteristic	Absolute measures (point estimate [95% UI])					Relative measures (point estimate [95% UI])			
	Per capita daily SSB consumption change (oz) (adults)	**Per capita daily SSB consumption change (oz) (children)**	**Cases of obesity prevented in 2032 (*n*) (all ages)**	**Obesity prevalence reduction in 2032 (%) (all ages)**	**Obesity prevalence reduction in 2032 (%) (children)**	**Per capita daily SSB consumption change ratio (adults)**	**Per capita daily SSB consumption change ratio (children)**	**Obesity prevalence reduction ratio (all ages)**	**Obesity prevalence reduction ratio (children)**
By race/ethnicity									
Non-Hispanic White	−1.77 (−3.80, −1.00)	−1.55 (−3.41, −0.91)	66,300 (30,800; 142,000)	0.501 (0.233, 1.070)	0.329 (0.131, 0.736)	ref	ref	ref	ref
Non-Hispanic Black	−3.43 (−7.28, −1.94)	−3.20 (−6.99, −1.87)	19,200 (9,010; 40,100)	0.912 (0.427, 1.870)	0.730 (0.278, 1.580)	1.93 (1.90, 1.96)	2.07 (2.00, 2.14)	1.82 (1.53, 2.27)	2.22 (1.42, 3.07)
Hispanic	−3.14 (−6.72, −1.77)	−2.29 (−5.03, −1.34)	151,000 (70,900; 303,000)	0.876 (0.410, 1.760)	0.619 (0.256, 1.340)	1.77 (1.76, 1.79)	1.48 (1.45, 1.51)	1.75 (1.47, 2.25)	1.88 (1.48, 2.49)
Non-Hispanic Asian	−1.57 (−3.34, −0.89)	−1.53 (−3.33, −0.90)	18,200 (8,530; 36,200)	0.374 (0.175, 0.747)	0.345 (0.141, 0.784)	0.89 (0.87, 0.9)	0.99 (0.94, 1.04)	0.75 (0.59, 0.97)	1.05 (0.75, 1.38)
Other racial/ ethnic identities	−2.46 (−5.25, −1.39)	−2.18 (−4.80, −1.28)	10,900 (5,160; 21,100)	0.617 (0.292, 1.180)	0.462 (0.177, 0.997)	1.39 (1.36, 1.41)	1.41 (1.37, 1.46)	1.23 (0.96, 1.74)	1.40 (1.01, 2.06)
By income as a percentage of (% FPL)									
0%−130% FPL	−2.89 (−6.19, −1.63)	−2.28 (−5.03, −1.33)	73,600 (34,800; 146,000)	0.778 (0.366, 1.540)	0.538 (0.241, 1.280)	1.48 (1.46, 1.49)	1.26 (1.24, 1.28)	1.40 (1.21, 1.73)	1.38 (1.20, 1.61)
131%−185% FPL	−2.81 (−5.99, −1.59)	−2.19 (−4.81, −1.28)	31,900 (14,700; 64,900)	0.761 (0.352, 1.550)	0.506 (0.210, 1.080)	1.43 (1.42, 1.45)	1.21 (1.18, 1.24)	1.37 (1.24, 1.56)	1.20 (0.98, 1.50)
186%−350% FPL	−2.60 (−5.57, −1.47)	−2.04 (−4.48, −1.19)	71,300 (33,600; 148,000)	0.746 (0.348, 1.540)	0.531 (0.218, 1.150)	1.33 (1.32, 1.34)	1.13 (1.11, 1.15)	1.34 (1.26, 1.44)	1.26 (1.06, 1.45)
≥350% FPL	−1.96 (−4.19, −1.11)	−1.81 (−3.98, −1.06)	88,900 (41,700; 186,000)	0.556 (0.260, 1.160)	0.423 (0.181, 0.918)	ref	ref	ref	ref

FPL, Federal Poverty Level; QALY, quality-adjusted life year; SSB, sugar-sweetened beverage; UI, uncertainty interval.

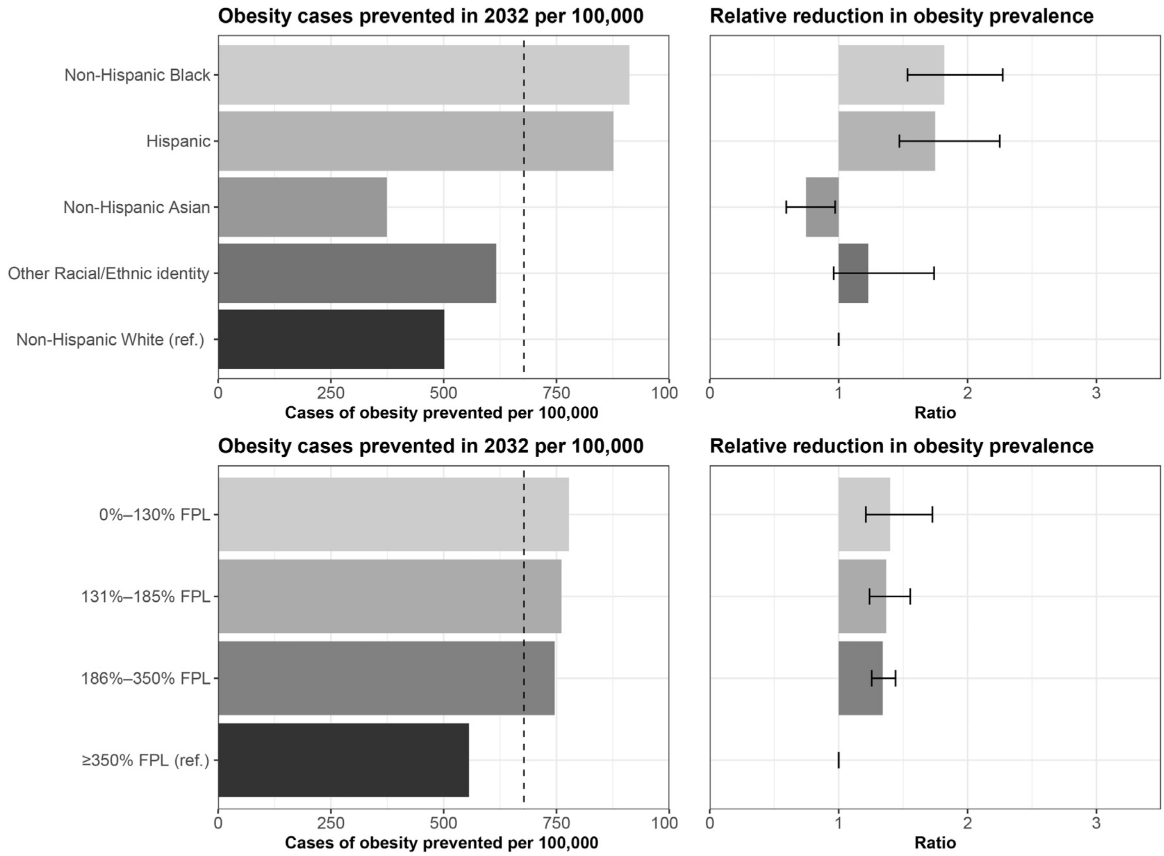

Figure 1. Projected absolute and relative cases of obesity prevented per 100,000 in 2032 after a $0.02/oz state-wide SSB excise tax in California, by race/ethnicity (top) and income categories as a percentage of the FPL (bottom).
The dashed line represents the overall population-average obesity cases prevented per 100,000 individuals in 2032.
FPL, Federal Poverty Line; Ref., referent; SSB, sugar-sweetened beverage.

BMI costing framework to account for more granular changes in healthcare costs as a result of individual BMI changes, thereby allowing for assessment of potential cost savings across the full BMI distribution in the population. Prior approaches assigned differential healthcare costs when individuals moved between weight categories, for example, from obese to overweight or normal weight categories.[20] Second, the model incorporated differential impacts of SSB consumption changes on obesity by baseline BMI on the basis of published evidence suggesting greater reductions in weight among those in the upper tail of the BMI distribution for the same reduction in SSB consumption.[11−13] Although the realities of future tax implementation are unknown, testing several scenarios allows for a broader understanding of the potential outcomes that might be seen.

Whereas opponents have argued that SSB taxes disproportionately burden consumers from low-income households,[27] results from this study suggest that a state-wide tax is likely to improve health equity.[28] First, taxes result in reductions in SSB-related spending across the entire racial/ethnic and income distribution. In this microsimulation, individual SSB spending was projected to decrease by $33 per adult and $26 per child in the first year. Those with lower incomes were projected to experience the greatest declines in SSB purchasing and intake, by as much as 30 liters per year for those between 0% and 130% FPL. Consequently, reductions in SSB spending were projected to be greatest for populations living with lower incomes and for non-Hispanic Black and Hispanic communities. Implementation of a state-wide tax may therefore result in greater household dollars saved for these groups, freeing up resources that can be used elsewhere. These differences are projected to lead to improvements in health equity on the basis of obesity prevalence. When examining differences by poverty level, those in the lowest income group were projected to experience 1.4 times the obesity prevalence reduction as those at the highest income. Larger differences were found by race/ethnicity, with non-Hispanic

Black and Hispanic individuals experiencing nearly twofold greater reductions in obesity prevalence than non-Hispanic White individuals.

Second, taxes can be valuable tools for generating revenue for key public health interventions. According to the Rudd Center, a $0.02/oz tax with 70% pass-through in California would generate $1.6 billion in 2023 alone.[25] During the revenue-allocation process, taxes provide an opportunity to engage communities and improve health equity further. In the U.S., revenues have been used to address community-driven priorities, including access to healthy foods, health services, physical activity opportunities, and early childhood education.[29] Revenues from the Oakland tax, which have totaled >$25 million,[30] have funded projects by the Alameda County Department of Public Health and Oakland Unified School District to promote nutrition education and health literacy as well as to reduce food insecurity.[31] Recent research from existing taxes in San Francisco, Seattle, and Philadelphia found a significant net transfer of funds, as much as $16.4 million in Philadelphia, toward programs benefitting communities with lower incomes.[28]

Local taxes on SSBs have been implemented in Berkeley (2015), Albany (2016), Oakland (2017), and San Francisco (2018) in California. Evidence suggests that these policies have led to increases in the prices of SSBs along with reductions in sales and consumption.[32] A state-wide policy may confer additional advantages. First, cross-border shopping, where consumers shift their purchases of SSBs to nearby cities without taxes, may reduce the overall impact on purchases. The extent of cross-border shopping varies, although Léger and Powell (2021) estimated that cross-border shopping in Oakland offset reductions in SSBs sales by 46% in the first 2−4 months and by 82% in 9−11 months.[33] A state-wide policy would reduce the negating influence of cross-border shopping. In addition, a state tax may promote a greater sense of fairness among beverage retailers because a broader policy would lower the competitive advantage of retailers in nearby cities.[34] SSB intake is also highest in counties that have not yet implemented taxes, and a state-wide policy represents an opportunity to address consumption in these areas (Appendix Figure 2, available online, and Appendix Table 4, available online).

Limitations

Cost-effectiveness analyses represent projections on the basis of the best available evidence from tax evaluations and studies of diet and weight change. Importantly, no study has yet examined the effect of a U.S.-based tax policy on weight outcomes directly, and results presented in this study leverage studies that examine the impacts of reduction in SSB intake on weight change. However, the CHOICES project has standard guidelines for evidence synthesis that prioritizes high-quality studies with limited bias, similar to systematic review methods. This study also assumed a fixed own-price elasticity of demand for all individuals in the study population. Although households with low incomes have been shown to be more price sensitive in response to an SSB tax in other countries, including Mexico, studies in the U.S. have provided less evidence for interaction in the price elasticity of SSBs by income.[35,36] Finally, results were reported using standard cutoffs for classifying obesity according to the Centers for Disease Control and Prevention, although some research suggests that use of lower thresholds for non-Hispanic Asian populations may more accurately reflect chronic disease risk across the BMI distribution for this group.[37] Future work examining chronic disease outcomes could evaluate the sensitivity of results if different standards are developed in the U.S.

CONCLUSIONS

SSB excise taxes are an effective strategy to reduce the consumption and purchasing of sweetened beverages. This microsimulation of a $0.02/oz state-wide excise tax on SSBs in California suggests the potential to promote healthy weight and substantial savings in related healthcare costs over 10 years, alongside improvements in health equity. Although SSB excise taxes are but 1 strategy, these findings reify their place in the policy toolkit to advance health and equity while generating important revenue that can be reinvested to build healthy communities.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2023.08.004.

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