UTAH: Sugary Drink Tax

CHOICES Learning Collaborative Partnership

SALT LAKE COUNTY HEALTH DEPARTMENT

Executive Summary

Continually rising rates of obesity represent one of the greatest public health threats facing the United States. Obesity has been linked to excess consumption of sugary drinks. Federal, state, and local governments have considered implementing excise taxes on sugary drinks to reduce consumption, reduce obesity, and provide a new source of government revenue.[1-4]

We modeled implementation of a state excise tax on sugary drinks, at a tax rate of $0.02/ounce. Powdered drink mixes were modeled at a tax rate of $0.0025 per reconstituted fluid ounce according to the package instructions.

The tax modeled is projected to be cost-saving and result in lower levels of sugary drink consumption, thousands of cases of obesity prevented, and hundreds of millions of dollars in health care cost savings. For every dollar invested, this tax is projected to save $28.88 in health care costs.

Results prepared by the Salt Lake County Health Department and the CHOICES Project Team at the Harvard T.H. Chan School of Public Health: McKinnon A, Ward Z, Barrett J, Cradock A, Resch S, Flax C, and Gortmaker S. December 2019. Funded by The JPB Foundation. Results are those of the authors and not the funders. For further information, contact choicesproject@hsph.harvard.edu and visit www.choicesproject.org

Background

Although sugary drink consumption has declined in recent years, adolescents and young adults in the United States consume more sugar than the Dietary Guidelines for Americans 2015-2020 recommends, with persistent racial and ethnic disparities.[5-9] According to recent estimates, 27% of adults and 14% of youth in Utah drink at least one soda or other sugary drink per day.[10,11] Public health researchers have suggested that excess intake of sugary drinks may be one of the single largest drivers of the obesity epidemic in the U.S.[12] An estimated 26% of adults[13] and 10% of youth[14] in Utah have obesity.

Consumption of sugary drinks increases the risk of chronic diseases through changes in body mass index (BMI), insulin regulation, and other metabolic processes.[15-17] Randomized intervention trials and longitudinal studies have linked increases in sugary drink consumption to excess weight gain, diabetes, cardiovascular disease, and other health risks.[15-16] There are persistent racial and ethnic disparities across both sugary drink consumption levels and rates of obesity and chronic disease.[5-8] In light of this evidence, the Dietary Guidelines for Americans 2015-2020[9] recommends that individuals limit sugary drink intake in order to manage their body weight and reduce their risk of chronic disease.

Targeted taxation has emerged as one recommended strategy to reduce consumption of sugary drinks.[18] This strategy has been studied by public health experts, who have drawn on the success of tobacco taxation and decades of economic research to model the estimated financial and health impact of a sugary drink excise tax.[19-22] Sugary drinks include all drinks with added caloric sweeteners. Proposed and enacted sugary drink excise taxes typically do not apply to 100% juice, milk products, or diet drinks. This report aims to model the projected effect of a sugary drink excise tax on projected health and disease outcomes over the next decade.

MODELING FRAMEWORK: How excise taxes can lead to better health

State excise tax is linked to change in BMI through change in sugary drink price and consumption

UTAH: Sugary Drink Tax

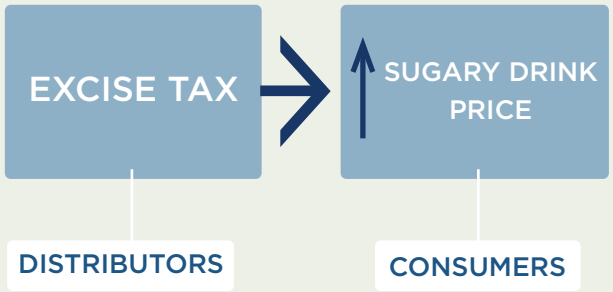
Key Terms

- **Excise tax**: a consumption tax collected from retailers or distributors; it is reflected in the posted price (a sales tax in contrast is applied after purchase of the item)
- **Pass-through rate**: how much of the excise tax on distributors is passed on to consumers as an increase in shelf price; a percent ranging from 0% (none of the tax) to 100% (all the tax)
- **Price elasticity of demand**: how much consumer purchasing behavior changes following a change in price of an item

How does an excise tax work?

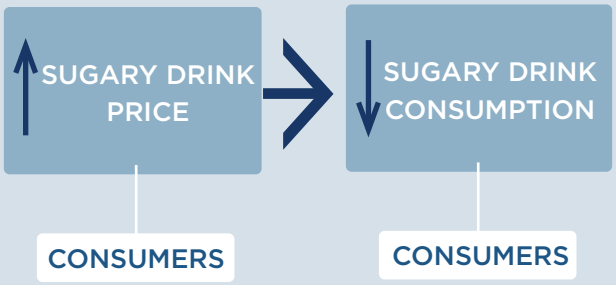
*Why an excise tax vs. a sales tax? Since an excise tax is mostly or entirely included in the price consumers see, it is more likely to affect consumer purchase behavior than a sales tax, which is added at the register.

How does an excise tax on distributors affect the price paid by consumers?



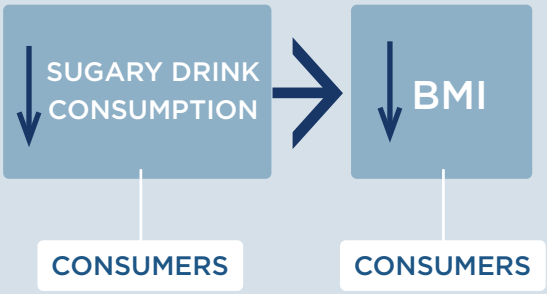
Since the cost of a sugary drink excise tax is incorporated directly into the beverage's sticker price, an excise tax will likely influence consumer purchasing decisions more than a comparable sales tax that is added onto the item at the register. We assume 100% pass-through of the tax over 10 years and assume the tax rate would be adjusted annually for inflation. Our pass-through rate estimate is supported by empirical studies of excise taxes in Mexico and France that demonstrate near-complete pass-through rates to consumers.[23] Short term studies for the local tax in Berkeley, CA indicate imperfect (or less than 100%) pass-through.[3,24,25] More recent analyses from Philadelphia, PA indicate that over all the sales studied, pass-through was close to complete. The pass-through seen in pharmacies was higher than in supermarkets and mass merchandise settings.[26] The expected change in sugary drink price was estimated using an average of $0.06/ounce based on national sugary drink prices.[27] The price per ounce in this study was based on a weighted average of sugary drink consumption across stores, restaurants, and other sources according to the estimates from the National Health and Nutrition Examination Survey (NHANES) 2009-2010. The price per ounce of sugary drinks purchased in stores was calculated using weighted averages of two-liter bottles, 12-can cases, and single-serve containers based on 2010 Nielsen Homescan data.[27] For example, a $0.02/ounce tax would raise the price of a 12-ounce can of soda from $0.72 to $0.96/can post-tax.

How does increasing the price of sugary drinks change individual sugary drink consumption?



We used national estimates of sugary drink consumption from NHANES 2011-2016 adjusted to local race- and ethnicity-specific estimates of adult sugary drink consumption from the Utah Behavioral Risk Factor Surveillance System[28] and youth sugary drink consumption from the Youth Behavioral Risk Surveillance System[10] to estimate current sugary drink consumption levels in Utah. The mean own-price elasticity of demand for sugar-sweetened soft drinks (not including diet) is -1.21.[29] The own-price elasticity reflects how much consumers will change their purchases in response to price changes. For example, an elasticity of -1.21 estimates that a 16% price increase would lead to a 19% reduction in purchases. Recent research on the Berkeley, CA tax found a 21% reduction in sugary drink intake among low-income populations consistent with this estimate.[24]

What are the individual health effects of decreasing sugary drink consumption?



Research has shown that decreasing sugary drink consumption can have positive effects on health in adults and youth. We conducted evidence reviews for the impact of a change in sugary drink intake on BMI, accounting for dietary compensation.[22] Four large, multi-year longitudinal studies in adults[16,30-32] were identified. The relationship was modeled using a uniform distribution based on the range of estimated effects on BMI due to reducing sugary drink intake; a one-serving reduction was associated with a BMI decrease of 0.21 kg/m^2 to 0.57 kg/m^2 in adults over a 3-year period. Among youth, a double-blind randomized controlled trial conducted over 18 months found that an additional 8-ounce serving of sugary drinks led to a 2.2 pound greater weight gain.[33]

Reach

The intervention applies to all youth and adults in Utah. However, the model estimates the health effects on those 2 years of age and older.*

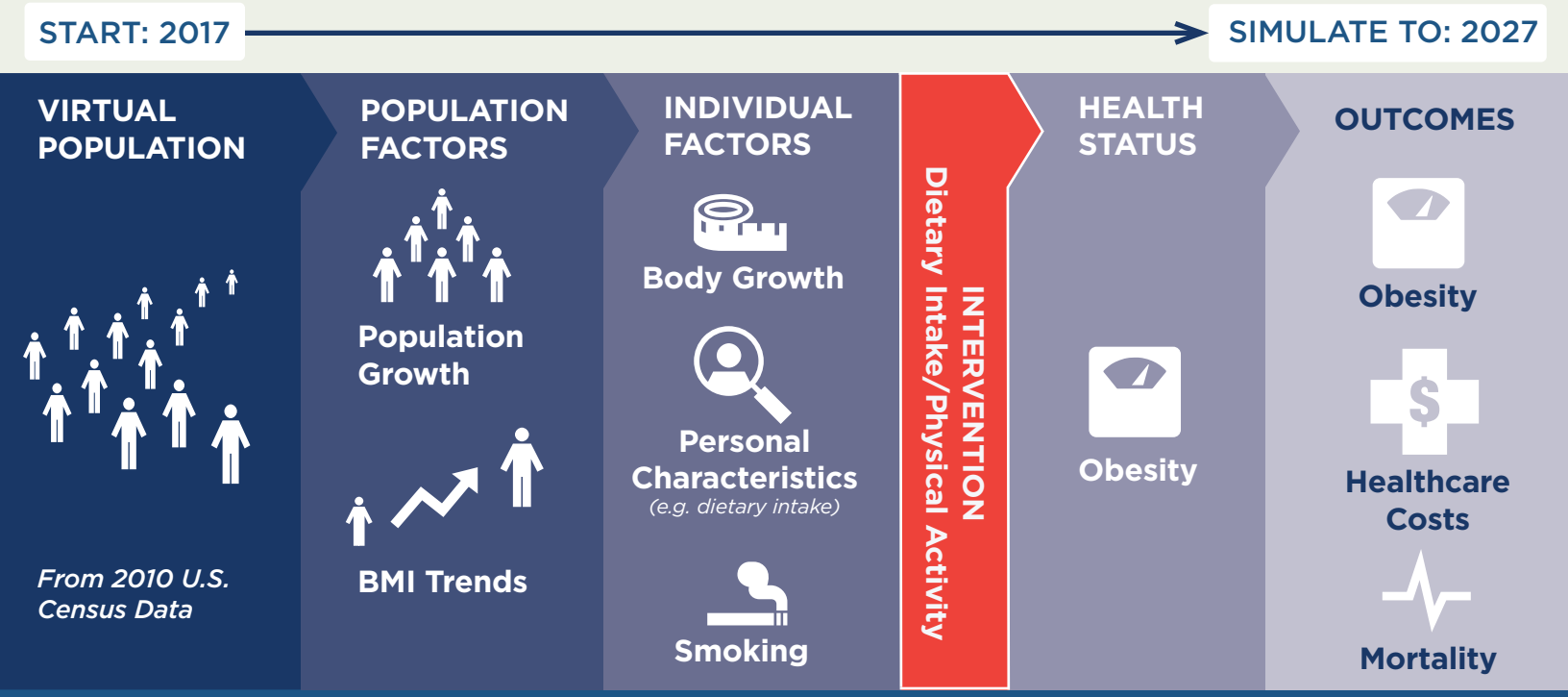
*BMI z-scores were used in our analyses, which are not defined for children under 2 years of age.

Implementation Costs

We assume the tax will incur start-up and ongoing labor costs for tax administrators in the Utah State Tax Commission.[34] To implement the intervention, the Utah State Tax Commission would need to process tax statements and conduct audits. Businesses would also need to prepare tax statements and participate in audits, which would require labor from private tax accountants. Cost information was drawn from localities with planned or implemented excise taxes on sugary drinks.[22] The cost and benefit estimates do not include expected tax revenue.

CHOICES Microsimulation Model

The CHOICES microsimulation model for Utah was used to calculate the costs and effectiveness over 10 years (2017–27). Cases of obesity prevented were calculated at the end of the model period in 2027. The model was based on prior CHOICES work,[22,35-37] and created a virtual population of Utah residents using data from: U.S. Census, American Community Survey, Behavioral Risk Factor Surveillance System, NHANES, National Survey of Children's Health,[37] the Medical Expenditure Panel Survey, multiple national longitudinal studies, and obesity prevalence data provided by Utah Department of Health. Using peer-reviewed methodology, we forecasted what would happen to this virtual population with and without a sugary drink tax to model changes in disease and mortality rates, and health care costs due to the tax.



Results: $0.02/ounce State Excise Tax on Sugary Drinks

Overall, the model shows that a sugary drink excise tax is cost-saving. Compared to the simulated natural history without a tax, the tax is projected to result in lower levels of sugary drink consumption, fewer cases of obesity, fewer deaths, and $132 million dollars in health care savings over the 10-year period under consideration.

The estimated reduction in obesity attributable to the tax leads to lower projected health care costs, offsetting tax implementation costs and resulting in net cost savings. The difference between total health care costs with no intervention and lower health care costs with an intervention represents health care costs saved; these savings can be compared to the cost of implementing the tax to arrive at the metric of health care costs saved per $1 invested.

The CHOICES microsimulation model does not include annual revenue generation from a state excise tax on sugary drinks in any of the cost-effectiveness calculations. Revenue is likely substantial. The Rudd Center Revenue Calculator for Sugary Drink Taxes estimates potential annual revenues from excise taxes on sugary drinks only and is "intended to provide a rough estimate" for municipalities to consider.[38] According to the Rudd Center,[38] a $0.02/ounce excise tax in Utah could raise as much as $181 million in 2019. Actual tax revenue may be lower than these projected estimates; the Rudd Center advises to adjust the revenues down by 10-30% to account for non-compliance. These would result in annual revenues of $127 - $163 million.

Results: $0.02/ounce State Excise Tax on Sugary Drinks

Outcome	$0.02/ounce excise tax Mean (95% uncertainty interval)
10 Year Reach*	**3,430,000** (3,420,000; 3,440,000)
First Year Reach*	**2,950,000** (2,940,000; 2,950,000)
Decrease in 12-ounce Servings of Sugary Drinks per Person in the First Year*	**90** (55; 159)
Mean Reduction in BMI Units per Person*	**-0.176** (-0.330; -0.090)
10 Year Intervention Implementation Cost per Person	**$1.33** ($1.30; $1.36)
Total Intervention Implementation Cost Over 10 Years	**$4.56 million** ($4.48 million; $4.65 million)
Annual Intervention Implementation Cost	**$456,000** ($448,000; $465,000)
Health Care Costs Saved Over 10 Years	**$132 million** ($59.6 million; $271 million)
Net Costs Difference Over 10 Years	**-$127 million** (-$267 million; -$55.1 million)
Quality Adjusted Life Years (QALYs) Gained Over 10 Years	**5,410** (2,470; 11,200)
Years of Life Gained Over 10 Years	**1,190** (473; 2,750)
Deaths Prevented Over 10 Years*	**354** (141; 791)
Years with Obesity Prevented Over 10 Years	**137,000** (69,700; 259,000)
Health Care Costs Saved per $1 Invested Over 10 Years	**$28.88** ($13.07; $58.76)
Cases of Obesity Prevented in 2027*	**19,600** (9,900; 36,700)
Cases of Childhood Obesity Prevented in 2027*	**2,760** (1,110; 6,150)
Cost per Year with Obesity Prevented Over 10 Years	**Cost-saving**
Cost per QALY Gained Over 10 Years	**Cost-saving**
Cost per YL Gained Over 10 Years	**Cost-saving**
Cost per Death Averted Over 10 Years	**Cost-saving**

Uncertainty intervals are estimated by running the model 1,000 times, taking into account both uncertainty from data sources and virtual population projections, and calculating a central range in which 95% of the model results fell.

All metrics reported for the population over a 10-year period and discounted at 3% per year, unless otherwise noted. *Not discounted

Results: $0.02/ounce State Excise Tax on Sugary Drinks By Race and Ethnicity

Outcome	Selected Results by Race and Ethnicity		
	White, Non-Hispanic **Mean** (95% uncertainty interval)	Other, Non-Hispanic **Mean** (95% uncertainty interval)	Hispanic **Mean** (95% uncertainty interval)
Decrease in 12-ounce Serving of Sugary Drinks per Person in the First Year*	**85** (52; 151)	**89** (55; 156)	**119** (73; 209)
Reduction in Obesity Prevalence in 2027*	**1.00**** 	**1.02** (0.87; 1.22)	**1.74** (1.52; 1.99)
Health Care Costs Saved over 10 Years	**$98.1 million** ($44.6; $201 million)	**$7.46 million** ($3.37; $15.6 million)	**$26.3 million** ($11.9; $54.9 million)
QALYs Gained Over 10 Years	**4,030** (1,830; 8,330)	**324** (146; 682)	**1,060** (491; 2,180)
Years of Life Gained Over 10 Years	**963** (371; 2,200)	**69** (11; 170)	**163** (50; 384)
Years with Obesity Prevented Over 10 Years	**96,100** (48,600; 180,000)	**9,410** (4,770; 17,700)	**31,500** (15,900; 58,900)
Cases of Obesity Prevented in 2027*	**13,800** (6,890; 25,900)	**1,320** (675; 2,520)	**4,430** (2,180; 8,300)
Cases of Childhood Obesity Prevented in 2027*	**1,690** (686; 3,780)	**298** (119; 691)	**765** (297; 1,740)

Uncertainty intervals are estimated by running the model 1,000 times, taking into account both uncertainty from data sources and virtual population projections, and calculating a central range in which 95% of the model results fell.

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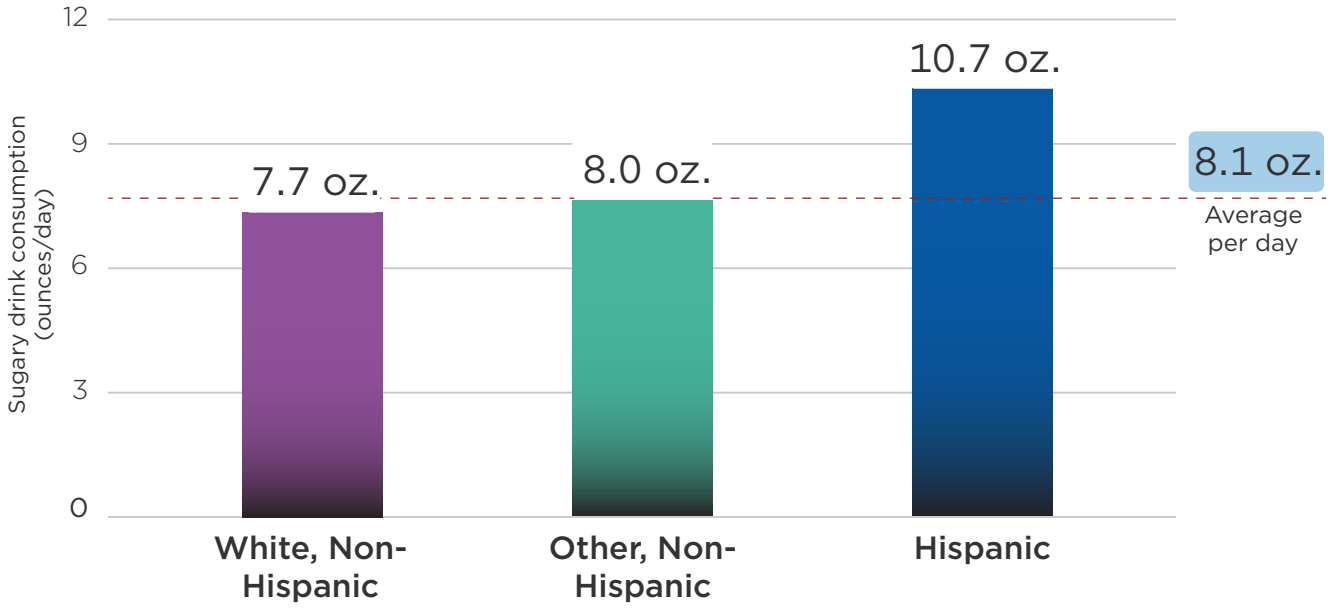
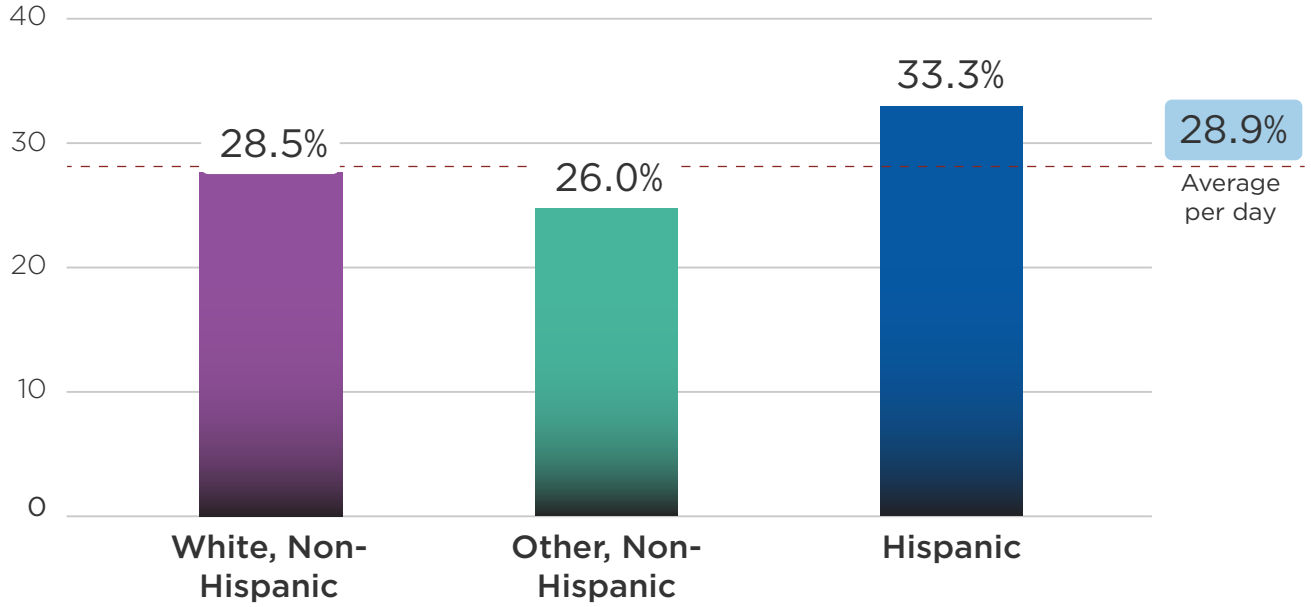
**Reference category

Pre-tax Sugary Drink Consumption in Utah by Race and Ethnicity



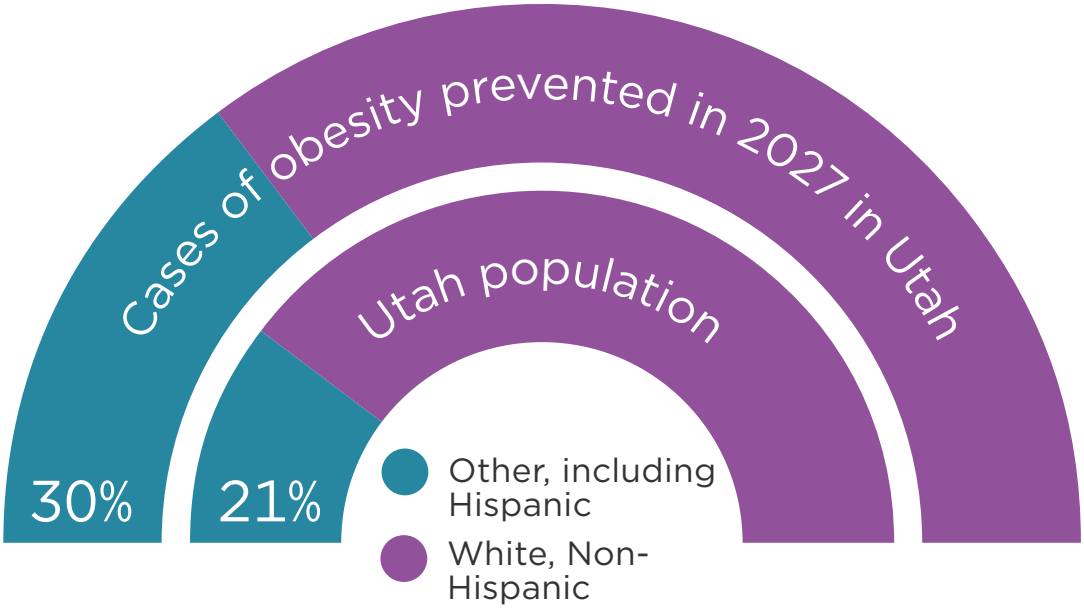
DATA SOURCES: Utah Behavioral Risk Factor Surveillance System 2013 and Youth Risk Behavior Survey 2017, NHANES 2011-2016; Model Analysis: CHOICES Project, 2019

Pre-tax Obesity Prevalence in Utah by Race and Ethnicity



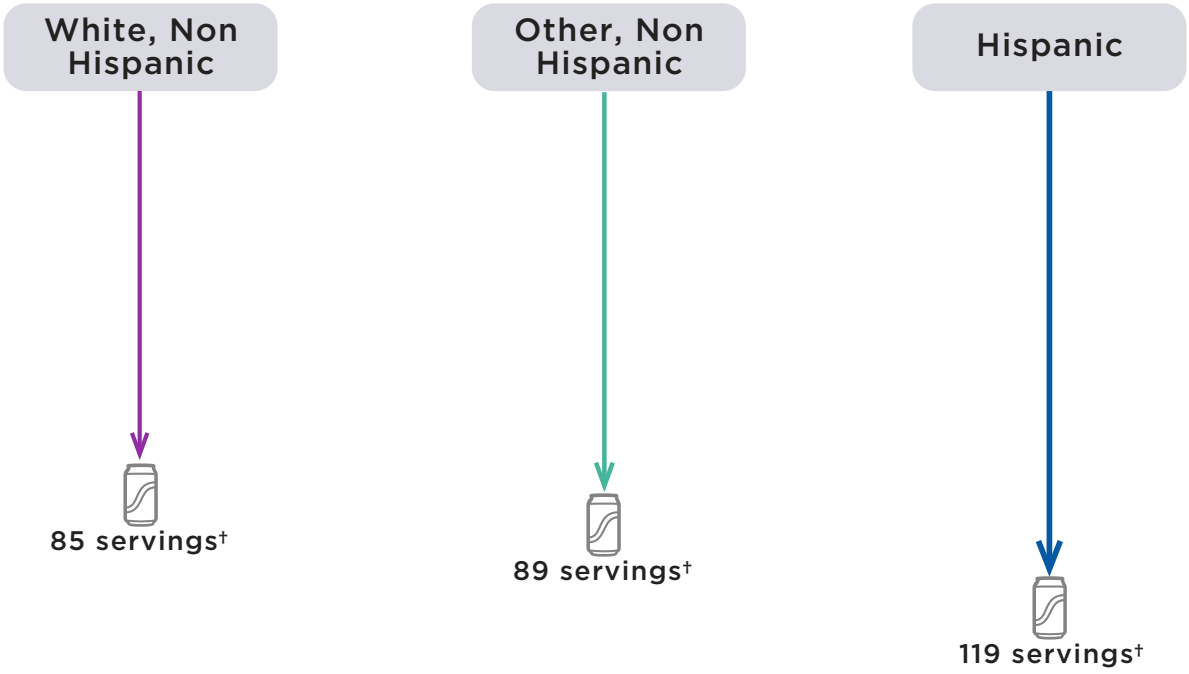
DATA SOURCES: Utah Behavioral Risk Factor Surveillance System 2017 and Youth Risk Behavior Survey 2017, NHANES 2011-2016; NSCH 2003, 2007; Model Analysis: CHOICES Project, 2019

Cases of Obesity Prevented in Utah in 2027*



*With an excise tax of $0.02/ounce on sugary drinks.

Decrease in Sugary Drink Consumption by Race and Ethnicity*

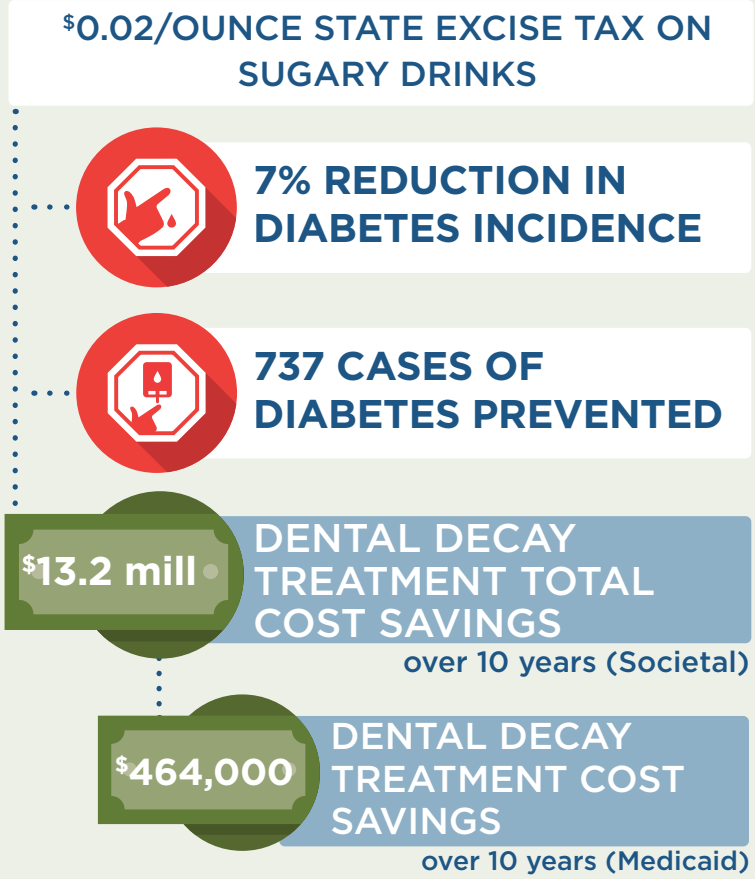


*With an excise tax of $0.02/ounce on sugary drinks.
†Each serving is 12 ounces.

Impact on Diabetes

We estimated the impact of the tax-induced reduction in sugary drink intake on diabetes incidence for adults ages 18-79 years using a published meta-analysis of the relative risk of developing diabetes due to a one-serving change in sugary drink consumption[39] as well as local estimates of diabetes. On average, each 8.5-ounce serving of sugary drinks per day increases the risk of diabetes by 18%.[39]

In Utah, we estimated that the proposed sugary drink excise tax would lead to a 7% reduction in diabetes incidence in the sugary drink tax model. Impact on diabetes incidence was calculated over one year once the tax reaches its full effect. Impact on diabetes was calculated based on summary results from the model, not directly via microsimulation.



Impact on Tooth Decay

We estimated the impact of a sugary drink excise tax on tooth decay cost using a longitudinal analysis of the relationship between intake of sugars and tooth decay in adults. On average, for every 10 grams higher intake of sugar per day, there is an increase in decayed, missing and filled teeth (DMFT) of approximately 0.10 over 10 years.[40] As described above, we assume that the excise tax will result in a reduction in sugary drink intake. There are many studies showing a similar relationship between higher intake of sugars and tooth decay in children and youth[41] and thus we assume the same relationship as found in adults.

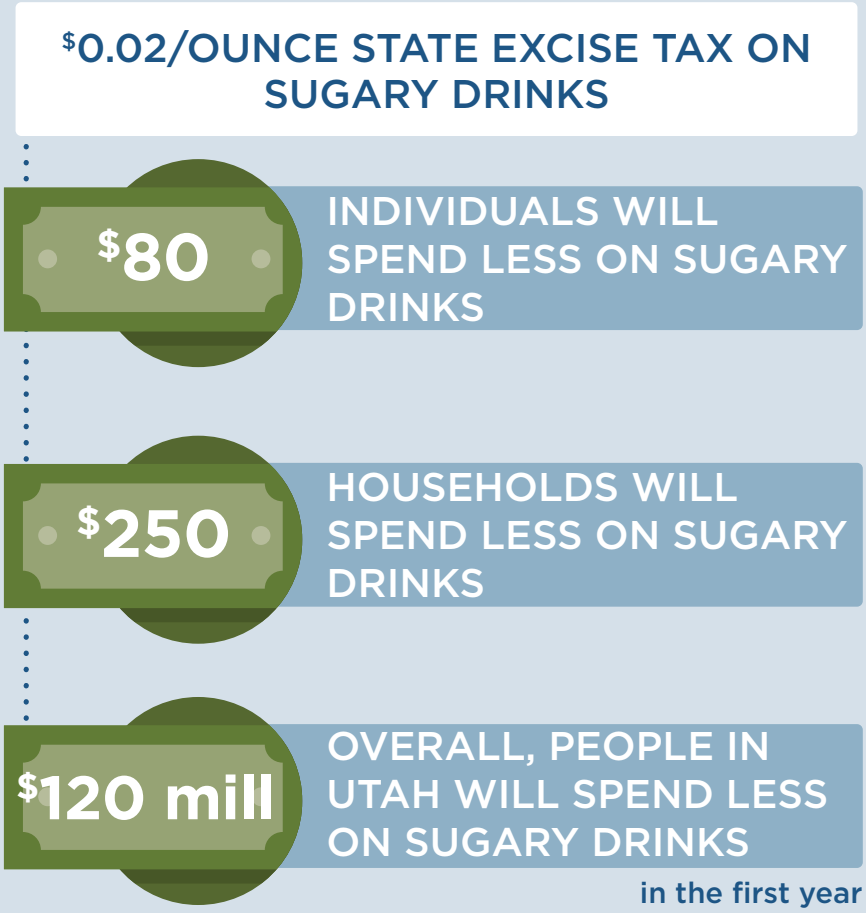
We used the Bureau of Coverage and Reimbursement Policy Coverage and Reimbursement Fee Schedule[42] data to estimate a Medicaid cost of treating DMFT as: $307.90 for a permanent crown and $45.54 for a filling. These codes reflect treatment for one surface and do not reflect higher reimbursement rates for multi-surface treatment, temporary crowns, or potential flat tax schedules. Based on analysis of data on tooth decay, fillings and crowns for the U.S. population from NHANES 1988-1994 (the last year crowns and fillings were separately reported),[43] we estimate that 78.9% of tooth decay in children and 43.5% of tooth decay in adults is treated. Using this same data set, we estimate that 97% of treatment for children is fillings and 82.5% of treatment for adults is fillings.

To estimate Medicaid-specific dental caries cost savings, we used local estimates of the number of people enrolled in Medicaid and the proportion of people receiving Medicaid dental services. Because of limited Medicaid dental coverage for adults in Utah, only children are included in the Medicaid-specific calculations. In Utah, we estimated that a $0.02/ounce tax would lead to a total of $464,000 in Medicaid savings over a period of 10 years due to a reduction in treatment of DFMT. The Medicaid reimbursement tax estimates may underestimate the total cost savings of tooth decay treatment projected here as dental providers may charge higher amounts to patients.

Considerations for Health Equity

Concerns have been raised regarding the impact of the tax on low-income households. For many goods, including cigarettes, low-income households are more price-sensitive than high-income peers. If this is also true for low-income sugary drink consumers, these households would spend less on sugary drinks after the tax goes into effect, which would free up disposable income for other consumer purchases.[44] Using sales data from the Rudd Center Revenue Calculator for Sugary Drink Taxes,[38] we project that individuals and households in Utah will spend less money on sugary drinks after the tax is implemented.

In addition, low-income consumers, on average, consume more sugary drinks than higher-income consumers. We project that greater health benefits from this policy will accrue to low-income consumers. We also project that greater health benefits will accrue among Hispanic Utah residents compared with non-Hispanic residents of white or other race. Using data from NHANES and Utah on sugary drink consumption in the CHOICES model, the average daily consumption of sugary drinks by people in Utah varies by race and ethnic group (see page 9). Under the proposed tax, Hispanic Utahns will experience a 74% greater reduction in obesity prevalence compared to White non-Hispanic residents. On that basis, the proposed tax could decrease disparities in obesity outcomes.



Implementation Considerations

Revenue raised from a sugary drink tax could also be reinvested in low-income communities. For instance, in Berkeley, CA, sugary drink tax revenue has been allocated for spending on school and community programs to promote healthy eating, diabetes, and obesity prevention; many serve low-income or minority populations.[45,46] Public support for such taxes generally increases with earmarking for preventive health activities.[46]

There is opposition from the food and beverage industry, which spends billions of dollars promoting their products.[47] Relatively small beverage excise taxes are currently applied across many states. The proposed tax is likely to be sustainable if implemented based on the successful history of tobacco excise taxes. There is potential for a shift in social norms of sugary drink consumption based on evidence from tobacco control tax and regulatory efforts.[48] This shift in norms can be facilitated by taxing sugary drinks, which reduces the attractiveness of non-caloric drink options and discourages consumers from selecting any sugary drink options when making beverage decisions.

Conclusion

We project that implementation of a state excise tax on sugary drinks only, at a tax rate of $0.02/ounce, will prevent thousands of cases of childhood and adult obesity, prevent new cases of diabetes, increase healthy life years, and save more in future health care costs than it will cost to implement. Implementing the tax could also serve as a powerful social signal to reduce sugar consumption.

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The information in this report is intended to provide educational information on the cost-effectiveness of sugary drink taxes.

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Appendix A
Health Effects of a $0.02/ounce Statewide Excise Tax on Sugary Drinks in Salt Lake County

Outcome	$0.02/ounce excise tax Mean (95% uncertainty interval)
10 Year Reach*	**1,260,000** (1,250,000; 1,260,000)
First Year Reach*	**1,090,000** (1,090,000; 1,090,000)
Decrease in 12-ounce Serving of Sugary Drinks per Person in the First Year*	**85** (52; 150)
Reduction in BMI Units per Person*	**-0.164** (-0.308; -0.085)
Health Care Costs Saved Over 10 Years	**$46.7 million** ($21 million; $95.4 million)
Quality Adjusted Life Years (QALYs) Gained Over 10 Years	**1,870** (862; 3,890)
Years of Life Gained Over 10 Years	**404** (152; 896)
Deaths Prevented Over 10 Years*	**121** (46; 267)
Years with Obesity Prevented Over 10 Years	**49,400** (25,100; 92,100)
Health Care Costs Saved per $1 Invested Over 10 Years	**$28.90** ($13.07; $58.76)
Cases of Obesity Prevented in 2027*	**7,000** (3,560; 13,100)
Cases of Childhood Obesity Prevented in 2027*	**1,170** (476; 2,620)

Uncertainty intervals are estimated by running the model 1,000 times, taking into account both uncertainty from data sources and virtual population projections, and calculating a central range in which 95% of the model results fell.

All metrics reported for the population over a 10-year period and discounted at 3% per year, unless otherwise noted. *Not discounted

Appendix B

Health Effects of a $0.02/ounce Statewide Excise Tax on Sugary Drinks in Salt Lake County: Results By Race and Ethnicity

Outcome	Selected Results by Race and Ethnicity		
	White, Non-Hispanic **Mean** (95% uncertainty interval)	Other, Non-Hispanic **Mean** (95% uncertainty interval)	Hispanic **Mean** (95% uncertainty interval)
Decrease in 12-ounce Serving of Sugary Drinks per Person in the First Year*	**77** (47; 137)	**84** (51; 143)	**115** (71; 204)
Reduction in Obesity Prevalence in 2027*	**1.00****	**1.04** (0.86; 1.29)	**1.82** (1.58; 2.16)
Health Care Costs Saved over 10 Years	**$31.2 million** ($13.9; $64 million)	**$3.32 million** ($1.51; $6.62 million)	**$12.2 million** ($5.74; $25.4 million)
QALYs Gained Over 10 Years	**1,240** (558; 2,630)	**141** (63; 295)	**489** (229; 1,010)
Years of Life Gained Over 10 Years	**300** (112; 680)	**29** (3; 72)	**75** (22; 170)
Years with Obesity Prevented Over 10 Years	**30,000** (15,100; 56,400)	**4,400** (2,230; 8,240)	**15,000** (7,670; 27,700)
Cases of Obesity Prevented in 2027*	**4,270** (2,110; 7,920)	**620** (313; 1,140)	**2,110** (1,070; 3,950)
Cases of Childhood Obesity Prevented in 2027*	**617** (244; 1,390)	**159** (64; 376)	**392** (150; 898)

Uncertainty intervals are estimated by running the model 1,000 times, taking into account both uncertainty from data sources and virtual population projections, and calculating a central range in which 95% of the model results fell.

All metrics reported for the population over a 10-year period and discounted at 3% per year, unless otherwise noted. *Not discounted
**Reference category