

**Health Impact Review of SB 5371  
Funding public health services and health equity initiatives through a statewide sweetened  
beverage tax (2021 Legislative Session)**

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**Full review**

The full Health Impact Review report is available at:

<https://sboh.wa.gov/Portals/7/Doc/HealthImpactReviews/HIR-2021-08-SB5371.pdf>

**Acknowledgements**

We would like to thank the key informants who provided consultation and technical support during this Health Impact Review.

**Disclosure**

The State Board of Health conducts Health Impact Reviews in collaboration with the Governor’s Interagency Council on Health Disparities.

During the 2019 Legislative Session, the State Board of Health was allocated ongoing funding through Foundational Public Health Services for 0.6 FTE to support Health Impact Review work. The Board is seeking funding for additional capacity (0.8 FTE) to support Health Impact Review work as part of the 2021-2023 Foundational Public Health Services budget request.

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**Executive Summary**  
**SB 5371, Funding public health services and health equity initiatives through a statewide  
sweetened beverage tax (2021 Legislative Session)**

**Evidence indicates that SB 5371 would likely increase the price of sweetened beverages, resulting in decreased purchases and consumption of these beverages, which would likely improve health outcomes for those who reduce consumption. The impacts on equity are unclear.**

**BILL INFORMATION**

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**Sponsors:** Robinson, Carlyle, Conway, Dhingra, Pedersen, Saldaña

**Summary of Bill:**

- Creates a tax on businesses distributing sweetened beverages beginning October 1, 2021.
- Creates a health equity account in the state treasury, requires 60% of revenue from the tax be deposited into this account, and requires that funds in the account be used to address social determinants of health in disproportionately impacted communities burdened by negative health outcomes with a focus on access to healthy foods, reducing food insecurity, access to healthcare, and supporting community infrastructure and capacity.
- Directs 40% of collected revenues to fund foundational public health services as defined in [RCW 43.70.515](#).

**HEALTH IMPACT REVIEW**

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**Summary of Findings:**

This Health Impact Review found the following evidence for provisions in SB 5371:

- **A fair amount of evidence** that creating a tax on businesses distributing sweetened beverages will increase the price of sweetened beverages for consumers.
- **A fair amount of evidence** that increasing the price of sweetened beverages will decrease purchases of sweetened beverages by consumers.
- **A fair amount of evidence** that decreasing the purchase of sweetened beverages among consumers will result in a decrease in consumption of sweetened beverages by consumers.
- **Very strong evidence** that decreasing consumption of sweetened beverages will improve health outcomes.
- **Unclear evidence** of the bill's impact on health inequities. This review found conflicting evidence as to how implementing a tax would affect low-income communities and communities of color. A large body of research has yet to be established. Other factors may also influence how this bill impacts inequities such as availability of untaxed sweetened beverages in neighboring jurisdictions.

## Introduction and Methods

A Health Impact Review is an analysis of how a proposed legislative or budgetary change will likely impact health and health disparities in Washington State ([RCW 43.20.285](#)). For the purpose of this review ‘health disparities’ have been defined as differences in disease, death, and other adverse health conditions that exist between populations ([RCW 43.20.270](#)). Differences in health conditions are not intrinsic to a population; rather, inequities are related to social determinants (e.g., access to healthcare, economic stability, racism). This document provides summaries of the evidence analyzed by State Board of Health staff during the Health Impact Review of Senate Bill 5371 ([SB 5371](#)).

Staff analyzed the content of SB 5371 and created a logic model depicting possible pathways leading from the provisions of the bill to health outcomes. We consulted with experts and contacted key informants about the provisions and potential impacts of the bill. We conducted an objective review of published literature for each pathway using databases including PubMed, Google Scholar, and University of Washington Libraries. More information about key informants and detailed methods are available upon request.

The following pages provide a detailed analysis of the bill, including the logic model, summaries of evidence, and annotated references. The logic model is presented both in text and through a flowchart (Figure 1). The logic model includes information on the strength-of-evidence for each pathway. The strength-of-evidence has been defined using the following criteria:

- **Very strong evidence:** There is a very large body of robust, published evidence and some qualitative primary research with all or almost all evidence supporting the association. There is consensus between all data sources and types, indicating that the premise is well accepted by the scientific community.
- **Strong evidence:** There is a large body of published evidence and some qualitative primary research with the majority of evidence supporting the association, though some sources may have less robust study design or execution. There is consensus between data sources and types.
- **A fair amount of evidence:** There is some published evidence and some qualitative primary research with the majority of evidence supporting the association. The body of evidence may include sources with less robust design and execution and there may be some level of disagreement between data sources and types.
- **Expert opinion:** There is limited or no published evidence; however, rigorous qualitative primary research is available supporting the association, with an attempt to include viewpoints from multiple types of informants. There is consensus among the majority of informants.
- **Informed assumption:** There is limited or no published evidence; however, some qualitative primary research is available. Rigorous qualitative primary research was not possible due to time or other constraints. There is consensus among the majority of informants.

- **No association:** There is some published evidence and some qualitative primary research with the majority of evidence supporting no association or no relationship. The body of evidence may include sources with less robust design and execution and there may be some level of disagreement between data sources and types.
- **Not well researched:** There is limited or no published evidence and limited or no qualitative primary research and the body of evidence has inconsistent or mixed findings, with some supporting the association, some disagreeing, and some finding no connection. There is a lack of consensus between data sources and types.
- **Unclear:** There is a lack of consensus between data sources and types, and the directionality of the association is ambiguous due to potential unintended consequences or other variables.

This review was subject to time constraints, which influenced the scope of work for this review. The annotated references are only a representation of the evidence and provide examples of current research. In some cases, only a few review articles or meta-analyses are referenced. One article may cite or provide analysis of dozens of other articles. Therefore, the number of references included in the bibliography does not necessarily reflect the strength-of-evidence. In addition, some articles provide evidence for more than one research question, so are referenced multiple times.

## Analysis of SB 5371 and the Scientific Evidence

### Summary of relevant background information

- Excise taxes are paid when purchases are made on a specific good and are often included in the price of the product.<sup>1</sup> Excise taxes can also be levied on activities.<sup>1</sup>
- A number of countries have implemented a sugar-sweetened beverage (SSB) tax, including France, Hungary, Mexico, and Pacific Islands countries and territories.<sup>2</sup>
- In 2014, the Navajo Nation passed the Healthy Diné Nation Act, which imposes a 2% tax on SSBs and foods high in salt, fat, and/or sugar.<sup>3</sup> The tax went into effect in 2015, and revenue has funded projects the Navajo define as health and wellness (e.g., vegetable gardens, exercise equipment, walking trails, and craft classes).<sup>3</sup>
- In 1992, Arkansas implemented an excise tax on ‘soft drinks’ (Arkansas Code Annotated [§26-57-904](#)),<sup>4</sup> which it defines to include all drinks commonly referred to as ‘cola’ or ‘soft drinks’ as well as any fruit or vegetable drink with less than 10% natural juice and any bottled coffee or tea.<sup>4</sup> The tax is collected from every distributor, manufacturer, or wholesale dealer as follows: \$1.26 per gallon of soft drink syrup or simple syrup; 20.6 cents per gallon of soft drink; and 20.6 cents for each gallon of soft drink that can be produced from a packaged powder or base product (i.e., mixed by retailer for sale to consumers) sold or offered for sale in the state.<sup>4</sup> Any retailer who purchases from an unlicensed distributor, manufacturer, or wholesaler is liable for the tax levied in the state on those purchases.<sup>4</sup> Revenues are directed to the State Treasury and credited to the “Arkansas Medicaid Program Trust Fund.”<sup>5</sup>
- No U.S. states have recently adopted a sweetened beverage tax. However, seven U.S. cities/counties have passed a sweetened beverage tax,<sup>6</sup> including Seattle, WA; Philadelphia, PA; Boulder, CO; and Berkeley, Albany, Oakland, and San Francisco, CA. While the tax rates vary across jurisdictions, the products taxed are similar in all seven locations, and all seven are volume-based excise taxes ranging from one to two cents per ounce (personal communications, February 2021).
- In 2017, the Seattle City Council passed [Ordinance 125324](#) creating the city’s Sweetened Beverage Tax.<sup>7</sup> Beginning January 1, 2018, Seattle started taxing distributors 1.75 cents per ounce on sweetened beverage products they distribute within the City of Seattle.<sup>8</sup> In 2019, the Sweetened Beverage Tax provided \$18.3 million and was invested to support healthy food access (53%), children’s health and early learning (43%), and tax administration (4%).<sup>8</sup>
- The 2015-2020 Dietary Guidelines for Americans (published by the U.S. Department of Agriculture [USDA]) recommended that added sugars make-up less than 10% of total calories per day.<sup>9</sup> In addition, the guidelines suggested choosing beverages with no added sugars.<sup>9</sup> USDA noted that sugar-sweetened beverages are one of the main sources of added sugars in U.S. diets, accounting for 47% of dietary sources of added sugars for individuals aged 2 years and older.<sup>9</sup>

### Summary of SB 5371

- Creates a tax on businesses distributing sweetened beverages beginning October 1, 2021.

- Sweetened beverage includes all drinks and beverages commonly referred to as soda, pop, cola, soft drinks, sports drinks, energy drinks, fruit drinks, sweetened ice teas and coffees, and other products with added caloric sweeteners.
- The tax rate is 1.75 cents per fluid ounce of sweetened beverage to be paid at the first nonexempt distribution. However, if a distributor or retailer receives taxable products on which the tax has not been paid, they are liable for the tax.
- Beginning July 1, 2022, and every July 1<sup>st</sup> thereafter, the tax rate must be adjusted to reflect the yearly increase of the previous calendar year's annual average consumer price index for all urban consumers, Seattle area, as published by the Washington State Economic and Revenue Forecast Council.
- Creates a health equity account in the state treasury, requires 60% of revenue from the tax be deposited into this account, and requires funds in the account be used to address social determinants of health in disproportionately impacted communities burdened by negative health outcomes with a focus on access to healthy foods, reducing food insecurity, access to healthcare, and supporting community infrastructure and capacity.
  - Establishes a community advisory board within Department of Health to make recommendations on allocating funds to support initiatives addressing social determinants of health and specifies that the board must consult with the Office of Equity and Governor's Interagency Council on Health Disparities when making funding recommendations.
- Directs 40% of collected revenues to fund foundational public health services as defined in [RCW 43.70.515](#).

### **Health impact of SB 5371**

Evidence indicates that SB 5371 would likely increase the price of sweetened beverages, resulting in decreased purchases and consumption of these beverages, which would likely improve health outcomes for those who reduce consumption. The impacts on equity are unclear.

### **Pathway to health impacts**

The potential pathway leading from the provisions of SB 5371 to health inequities are depicted in Figure 1. There is a fair amount of evidence that creating a tax on businesses distributing sweetened beverages will increase the price of sweetened beverages for consumers.<sup>6,10-21</sup> There is also a fair amount of evidence that increasing the price of sweetened beverages will decrease purchases<sup>6,12-15,19-24</sup> and subsequently decrease consumption of sweetened beverages by consumers.<sup>12,15,17,22,23,25-30</sup> There is very strong evidence and it is well-documented that decreasing consumption of sweetened beverages improves health outcomes.<sup>31-35</sup> It is unclear from available evidence how the bill would impact health inequities. This review found conflicting evidence as to how implementing a tax would affect low-income communities and communities of color. A large body of research has yet to be established. Other factors may also influence how this bill impacts inequities such availability of untaxed sweetened beverages in neighboring jurisdictions or on tribal lands.

## Scope

Due to time limitations, we only researched the most direct connections between the provisions of the bill and decreased health inequities and did not explore the evidence for all possible pathways. For example, we did not evaluate potential impacts related to:

- The potential economic impacts for individuals who continue to purchase SSBs.
- Reformulation. Key informants shared that some countries that have adopted a sweetened beverage tax have experienced companies reformulating beverages (e.g., replacing sugar with non-nutritive alternatives). While these alternatives are often marketed as healthy options, researchers have noted that the health outcomes of many alternatives are not well-researched.<sup>31,32</sup> In a systematic review and meta-analysis examining the impacts of artificially-sweetened beverages, the authors found that consumption of artificially-sweetened beverages was associated with increased risk of obesity, Type 2 diabetes, hypertension, and all-cause mortality.<sup>32</sup> For every 250 mL/day (1 additional serving per day) increase in the consumption of artificially-sweetened beverages, risk increased by 21% for obesity, 19% for Type 2 diabetes, 8% for hypertension, and 6% for all-cause mortality.<sup>32</sup>
- Substitution. Key informants also shared that there is limited research on product substitution, and that some consumers may replace sweetened beverages with other sugary snacks.

## Magnitude of impact

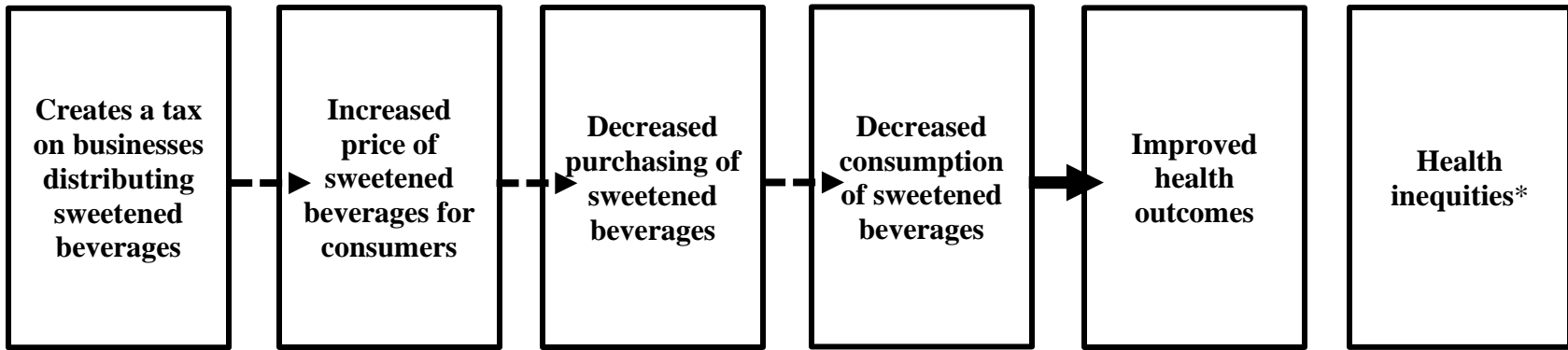
The Washington State Department of Revenue estimated a tax on sweetened beverages would impact 8,300 businesses distributing SSBs.<sup>36</sup> According to the Washington State Department of Revenue, “tribal members/citizens do not pay state taxes for their transactions that occur in their Indian Country.”<sup>37</sup> The proposed excise tax on sweetened beverages would not apply to a tribal or tribal-member owned business operating in Indian Country (i.e., land over which a tribe has legal jurisdiction) (personal communication, Department of Revenue, February 2021). However, since the cost of the excise tax is likely to be passed from distributors to consumers, tribes, tribal members, or patrons within Indian Country would likely pay more for their SSBs (personal communication, Department of Revenue, February 2021). Therefore, a tax on sweetened beverages will likely impact any individual that purchases and consumes a SSBs in the state.

Nationally, approximately 50% of adults<sup>38</sup> and 63% of youth (aged 2 to 19 years)<sup>39</sup> consume at least one SSB on a daily basis. SSBs accounted for approximately 6.5% of daily caloric intake for adults<sup>38</sup> and 7.3% of daily caloric intake for youth.<sup>39</sup>

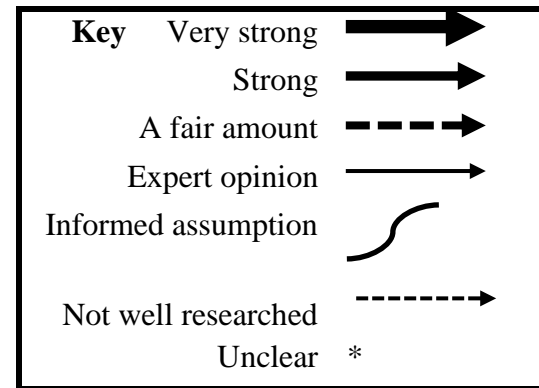
In 2019, the Behavioral Risk Factor Surveillance System (BRFSS) survey asked about SSB consumption in Washington State. Approximately 72% of individuals reported drinking SSBs in the past 30 days, with an average consumption rate of 21.4 drinks per month.<sup>40</sup>



Logic Model



**Figure 1:**  
**Funding public health services and health equity initiatives**  
**through a statewide sweetened beverage tax.**  
**SB 5371**



## Summaries of Findings

### **Will creating a tax on businesses distributing sweetened beverages increase the price of sweetened beverages for consumers?**

There is a fair amount of evidence that creating a tax on businesses distributing sweetened beverages will increase the price of sweetened beverages for consumers.

The tax on sweetened beverages proposed in SB 5371 is a general excise tax, not a tax on the consumption, use, or gross receipts of sweetened beverages.<sup>36</sup> Although an excise tax is officially paid by distributors, economists recognize that “in a perfectly competitive market who actually pays the tax is determined by the relative elasticities of supply and demand.”<sup>10</sup> The passage of the cost of an excise tax from the distributor and/or retailer to the final consumer through a price increase is known as ‘pass-through.’ In cases where “consumer demand is completely insensitive to price (i.e., demand is perfectly inelastic), then producers can fully pass on the tax to consumers [i.e., 100% pass-through] without experiencing any decline in demand or sales.”<sup>10</sup> Conversely, “if demand is perfectly elastic, then producers do not pass on any of the tax to consumers because they would lose all of their sales.”<sup>10</sup> When demand is partially elastic, then the tax is paid in part by producers and in part by consumers, “with the exact proportions determined by the relative elasticities of supply and demand.”<sup>10</sup> For example, pass-through may be lower if a large number of nontaxed substitutes are available or consumers are able to easily avoid paying the tax (e.g., shopping at retailers not subject to the tax).<sup>11</sup> Finally, “if the market is imperfectly competitive, due to strategic pricing, taxes could be undershifted, fully shifted, or even overshifted (i.e., the retail price could increase by an amount greater than the tax).”<sup>10</sup> Multiple studies have been conducted in jurisdictions with sugar-sweetened beverage (SSB) taxes to determine the range of tax pass-through.

Available peer-reviewed research has observed sweetened beverage tax pass-through varies by location<sup>12</sup> and store type.<sup>6,11</sup> A review of evidence found the pass-through was partial in Berkeley, CA, complete in Philadelphia, PA, and mostly passed through in Boulder, CO.<sup>12</sup> Researchers have also observed pass-through variation among retailer types, including drugstores or pharmacies (18%<sup>13</sup> to 104%),<sup>14</sup> convenience stores (37% to 93%),<sup>10</sup> small independent stores (120%),<sup>6</sup> supermarkets (43%<sup>14</sup> to 107%),<sup>15</sup> small grocery stores or small chain supermarkets (0%<sup>16</sup> to 131%),<sup>15</sup> and liquor stores (135%).<sup>13</sup> The only study to examine beverage taxes on prices in restaurants found that in Boulder, the pass-through of the city’s two cents per ounce tax was roughly 69% at four months after implementation.<sup>12</sup> Among retailers, pass-through has also varied by taxable beverage type<sup>13</sup> (e.g., energy drink, soda, sweetened tea), brand,<sup>13</sup> container size,<sup>13,16</sup> distance to the nearest store selling untaxed SSBs,<sup>10,16</sup> and characteristics of the local population.<sup>16</sup>

Evidence from Seattle shows that 12 months after implementation of the city’s Sweetened Beverage Tax the price of taxed beverages did increase, above and beyond price changes in the comparison area (except for sweetened syrups added to coffee drinks).<sup>17</sup> Evidence showed that: “The overall average price increase was 1.55 cents per ounce, which represents 89% of the tax passed through to consumers.”<sup>17</sup> Pass-through also varied by product: “Soda had the lowest price pass-through of all beverage types, and bottled tea had the highest price pass-through. The amount of the tax passed through to the consumer ranged from 82% to 115% by beverage.”<sup>17</sup>

Prices also increased significantly in most store types within Seattle: “The percentage of the tax passed through to the consumer on average was: 113% in quick service restaurants, 101% in grocery and drug stores, 86% in superstores and supermarkets, and 82% in small stores.”<sup>17</sup> Evaluators also found that prices in stores near the northern and southern borders (within 1-mile) of Seattle also increased. However, “the pass-through was lower (64% tax price pass-through) in stores close to the border than the citywide average (89% tax price pass-through).”<sup>17</sup>

Therefore, available evidence indicates that creating a tax on businesses distributing sweetened beverages in Washington will likely increase the prices of these products to varying degrees (dependent on the elasticity of consumer demand, store type, product, distance to nearest retailer not subject to the tax, etc.).

### **Will increasing the price of sweetened beverages for consumers decrease purchasing of sweetened beverages?**

There is a fair amount of evidence that increasing the price of sweetened beverages for consumers will decrease purchasing of sweetened beverages.

As there is no standard accepted way of measuring sales, researchers have used a variety of measurements and approaches to assess the impact of SSB taxes (e.g., ounces per transaction, overall volume of sales). Additionally, data availability has limited the generalizability of research findings to certain settings. Specifically, the data sets available with point-of-sale data or consumer reported purchases each have their own limitations (e.g., limited store types) resulting in no one data set tracking the full universe of stores where consumers may purchase SSBs. For example, some studies only include large supermarket chains and drugstore chains for which point-of-sale data has already been collected, while other studies include only small independent corner stores where researchers have collected data from the field. Finally, our literature search did not identify any studies examining how SSB taxes have affected purchases of taxed beverages at restaurants and fast-food establishments.

A systematic review of real-world SSB tax evaluations (including U.S. and international studies) and meta-analysis examining the overall impact of such taxes on beverage purchases found “the equivalent of a 10% SSB tax was associated with an average decline in beverage purchases of 10.0% [...] with considerable heterogeneity between results.”<sup>23</sup> More recent studies in the U.S. have also found evidence that price increases associated with SSB taxes result in decreased purchasing of taxed products.<sup>6,14,19-21</sup> For example, an analysis of Seattle’s tax found that one year post-tax implementation “volume sold of taxed beverages fell, on average, 22%” which was statistically significant.<sup>20</sup> Volume sold of family-sized beverages fell to a greater extent than did individual-sized beverages (31% versus 10%).<sup>20</sup> In Cook County, Illinois, a SSB tax was implemented and then quickly repealed 4 months later.<sup>19</sup> An analysis found that taxed beverage prices increased (1.13 to 1.45 cents per fluid ounce) following implementation of Cook County’s SSB tax and the volume of taxed beverages sold decreased 25.7% compared to the control jurisdiction.<sup>19</sup> Furthermore, results showed that following the repeal, prices decreased to their pretax level and there was no net change in volume of SSBs sold from pretax to 8 months after repeal.<sup>19</sup> Overall, evidence indicates that purchases of SSBs tend to decrease significantly in jurisdictions where a tax is implemented and distributors pass-through the tax to consumers in the form of price increases.

The degree to which purchases of SSBs decrease seems “to be partly offset by residents increasingly shopping outside of the taxing jurisdiction (i.e., engaging in cross-border shopping).”<sup>12</sup> A 2019 review of literature and multiple studies analyzed found evidence that cross-border shopping may impact the effectiveness of SSBs taxes.<sup>12-14,18,21,22</sup> For example, a study in Philadelphia found that there was not a significant increase in the percentage of residents shopping outside the city, but “the Philadelphia residents who were observed engaging in cross-border shopping were 173% more likely to be buying beverages that would have been taxed in Philadelphia.”<sup>12</sup> A separate analysis of Philadelphia’s tax using point-of-sale data found that demand for SSBs decreased by 46% in response to the tax.<sup>21</sup> Another study of Philadelphia’s tax found similar results.<sup>14</sup> However, cross-border shopping to stores outside of Philadelphia offset more than half of the reduction in sales in the city and decreased the net reduction in sales of taxed beverages to 22%.<sup>21</sup> Meanwhile, an analysis of Seattle’s tax found no significant increases in the overall volume of taxed beverages sold in the 2-mile border area of Seattle relative to its comparison site. Findings suggest that cross-border shopping did not offset the impact of Seattle’s Sweetened Beverage Tax.<sup>20</sup>

Differences in cross-border shopping depend on “local conditions, such as local consumers’ price elasticity of demand, the opportunity cost of consumers’ time, the competitiveness of the local retail market, [...] public transportation network, extent of vehicle ownership, and density and location of retailers, both inside the taxing jurisdiction and in neighboring areas.”<sup>12</sup> As no state has recently implemented a SSB tax, and no evaluation was available for Arkansas’ tax, it is unknown to what extent cross-border shopping will affect overall purchasing of taxable beverages in different parts of a state or among different communities.

Overall, a fair amount of evidence suggests that increasing the price of sweetened beverages by implementing a tax on these products will likely result in some number of consumers decreasing their purchase of sweetened beverages. However, the degree to which consumers decrease purchasing will vary.

### **Will decreased purchasing of sweetened beverages decrease consumption of sweetened beverages?**

There is a fair amount of evidence that decreased purchasing of sweetened beverage, as a result of SSB taxes and resulting price increases, will likely decrease consumption of sweetened beverages.

Key informants shared that accurately measuring consumption is a challenging task. As such, studies vary in both their measurement approach and the units of measurement included (e.g., frequency of consumption, grams of sugar, calories from SSB). Asking an individual to recall what they consumed within the last 24 hours (i.e., a 24-hour recall) is the gold standard for capturing consumption while limiting recall bias (personal communication, February 2021). However, due to significant variability in people’s diets two recalls are necessary to more accurately assess consumption, and the approach can be quite expensive (personal communication, February 2021). Instead, reviewed studies generally used screener questions, which tend to be error prone (personal communication, February 2021). Additionally, available data do not capture the full universe of purchasing (e.g., all retail store types, restaurants, fast food establishments, other venues that offer beverages for purchase, vending machines), and

many settings have not been evaluated to determine what portion of an excise tax may be passed through to consumers via increased prices. Therefore, generalizability of findings varies. Alternatively, some researchers have relied on purchasing data to model changes in consumption. However, such modeling requires researchers to make certain assumptions. One economic analysis called into question the static models used to estimate changes in consumption behaviors.<sup>26</sup> Instead, the author explored a dynamic demand model that considered: 1) SSBs as storable products that experience frequent price reductions and 2) consumers' taste heterogeneity.<sup>26</sup> The author concluded that static analyses overestimate the long-run own-price elasticity of regular soda, which leads to overestimated consumption reductions of SSBs in some cases.<sup>26</sup>

Despite measurement challenges and data limitations, a growing body of literature has attempted to assess changes in consumption following the implementation of SSB taxes. Most studies have found evidence indicating higher prices of SSBs are associated with decreased consumption of some, if not all, types of SSBs.<sup>12,23,25,27,28,30</sup> For example, a study of short-term impacts of Philadelphia's beverage tax on SSB consumption found that the odds of daily consumption declined 40% for SSBs and 64% for energy drinks following the implementation of the tax.<sup>25</sup> Additionally, monthly SSB consumption declined by 38%.<sup>25</sup> Another study assessing frequency of SSB consumption following Berkeley's tax found that, after adjusting for covariates, reductions in SSB consumption "were sustained in demographically diverse neighborhoods over the first 3 years of an SSB tax, relative to comparison cities."<sup>28</sup> A meta-analysis including studies from the U.S. and internationally found that overall "the equivalent of a 10% SSB tax was associated with an average decline in dietary intake of 10% [...] with considerable heterogeneity between results."<sup>23</sup> Results of a longitudinal survey conducted in Philadelphia showed participating adults reduced their frequency of soda consumption by 31% following the city's implementation of the tax.<sup>22</sup> Meanwhile, "the tax had no detectable impact on children's consumption of soda or all taxed beverages, although children who were frequent consumers [of SSBs] prior to the tax reduced their consumption [by 22%] after the tax."<sup>22</sup>

While most studies found evidence supporting the association between decreased purchases and decreased consumption, two studies were unable to determine if the tax, and resulting increase in prices, affected consumption of SSBs.<sup>15,17</sup> The only study to use a 24-hour recall of beverage intake to examine SSB tax impacts on consumption concluded it was unclear whether consumption changes could be attributed to the tax.<sup>15</sup> An evaluation of Seattle's Sweetened Beverage Tax found that lower-income children and parents living in Seattle who participated in the survey reduced sugary beverage consumption from before to 12 months after the tax was implemented.<sup>17</sup> However, "unexpectedly, the reductions observed among Seattle families were similar to reductions observed among comparison area families over the one-year period."<sup>17</sup> Authors noted findings could be the result of "general norms and trends in sugary beverage consumption, limitation in [the] measurement of beverage consumption, or other unknown factors affecting beverage consumption among lower-income families in [the] region."<sup>17</sup>

Overall, a growing body of evidence indicates that taxes on SSBs are associated with increased prices and decreased purchasing of sweetened beverages, and there is a fair amount of evidence this will result in decreased consumption of these products.

### **Will decreased consumption of sweetened beverages improve health outcomes?**

There is very strong evidence and it is well-documented that decreasing consumption of sweetened beverages improves health outcomes. There is a large body of robust systematic reviews and meta-analyses demonstrating that consumption of SSBs is associated with multiple adverse health outcomes, including obesity, Type-2 diabetes, hypertension, cardiovascular disease, non-alcoholic fatty liver disease, dental caries, tooth erosion, and mortality.<sup>31-35</sup> These associations have been found across the lifespan. Since these links are well-documented and this connection is widely accepted, less time was dedicated to researching this relationship.

Many researchers have examined the dose-response relationship between consumption of SSBs and health outcomes, suggesting that higher consumption levels increase health risks. In a meta-analysis of 39 articles, researchers calculated that for every 1 additional serving of SSBs per day, risk increased by 12% for obesity, 15% for Type 2 diabetes, 10% for hypertension, and 4% for all-cause mortality.<sup>32</sup> Another meta-analysis found that one additional serving of SSBs per day was associated with a 9% increase of cardiovascular disease and an 8% increase of cardiovascular disease-related mortality.<sup>31</sup> A meta-analysis examining dental health also found that “those consuming SSBs daily or several times-a-week have greater odds of having dental caries and erosion than people who consume SSB less than twice-a-week”, also demonstrating a dose-response relationship.<sup>35</sup> Another meta-analysis found that consumption of SSBs increased the odds of non-alcoholic fatty liver disease by 40%.<sup>33</sup> Lastly, a meta-analysis found that high SSB consumption was associated with higher systolic blood pressure and increased odds of hypertension in children and youth younger than 19 years of age.<sup>34</sup>

There is a gap in the literature synthesizing the direct and indirect impacts of a SSB tax on health outcomes.<sup>2</sup> However, the protocol for a pending Cochrane Review stated that “empirical evidence is becoming available, based on data from countries...that have already implemented SSB taxes. This includes research on the association between the existence of [country]-level soft drink and other high caloric food taxes, and the incidence of obesity.”<sup>2</sup> The CHOICES Project at the Harvard T.H. Chan School of Public Health has modeled the potential health outcomes of SSB taxes.<sup>41,42</sup> The model assumes an increase in price to consumers and a decrease in consumption and uses data from published meta-analyses and national health surveys to predict impacts.<sup>41,42</sup> Using their model, the Project estimated the “impact of the tax-induced reduction in sugary drink intake on diabetes incidence for adults ages 18-79.”<sup>42</sup> They found that: “In Seattle, WA, we estimated that the proposed SSB excise tax would lead to a 5% reduction in diabetes incidence—an estimated 130 cases of diabetes prevented—over a one-year period once the tax reaches its full effect.”<sup>41</sup> In Denver, CO, their model suggested an SSB tax would reduce diabetes by 7%.<sup>42</sup> While these estimates are based on modeling predictions, they suggest that an excise tax on SSBs has the potential to have direct impacts on health outcomes.

Overall, there is very strong evidence and it is well-documented that decreasing consumption of sweetened beverages improves health outcomes.

### **Will improved health outcomes decrease health inequities?**

There is unclear evidence of how creating a tax on businesses distributing sweetened beverages would likely impact health inequities. This review found conflicting evidence as to how implementing a tax would affect low-income communities and communities of color. A large

body of research has yet to be established. Other factors may also influence how this bill impacts inequities such as availability of untaxed sweetened beverages in neighboring jurisdictions. In addition, there is no evaluation available for how an excise tax would affect prices, purchasing, and consumption of SSBs in either rural areas or on a state level.

Evidence shows consumption of SSBs varies by both socioeconomic status and race/ethnicity.<sup>40</sup> These communities also experience worse health outcomes. Inequities are not inherent to an individual's identity. Rather, inequities are influenced by social determinants that systematically marginalize groups due to their identity. For example, adverse health outcomes, like Type 2 diabetes, are not inherent to an individual's race/ethnicity. Rather, they are influenced by social determinants of health like racism, which contributes to inequities like socioeconomic status which are associated with adverse opportunities and outcomes. Inequities can be exacerbated or alleviated by intersecting identities, and people of color are more likely to experience low incomes.

#### *Inequities by income/socioeconomic status*

This review found conflicting evidence as to how implementing a tax would impact consumers in low-income communities.<sup>16,21,22,24,26,43</sup> A 2016 systematic review of literature identified five studies examining the effects of SSB taxes (i.e., 20% sales tax, 20% excise tax, or 0.5 cents per ounce tax) on the amount paid in tax based on socioeconomic status.<sup>43</sup> Overall, “[a]ll of these studies reported the tax to be financially regressive whereby lower-income households would pay a greater proportion of their income in additional tax.”<sup>43</sup> However, studies showed “the monetary burden across all households is small [average \$20<sup>A</sup> paid in SSB tax per household per year], with relatively minor differences between higher- and lower-income households (0.10–1.0% and 0.03–0.60% of annual household income paid in SSB tax for low- and high-income households, respectively, equating to less than \$5 per year).”<sup>43</sup> One modeling study found that “for all taxes at all pass-through levels, [low-income] households experience the largest reduction in consumption and [high income] households the experience the least.”<sup>26</sup> These findings are based on pass-through levels being equivalent across all socioeconomic groups. Findings also suggest greater relative health benefits for consumers of lower (compared with higher) income.<sup>27,43</sup>

Some more recent studies of SSB taxes in U.S. cities have found conflicting results. A study evaluating Oakland's one cent per ounce SSB tax found that pass-through was lower (i.e., prices did not increase as much) at stores with higher percentages of local residents living below the federal poverty level (FPL).<sup>16</sup> The study also found “larger declines in the availability of untaxed beverages in stores with relatively high percentages of local households living [below the FPL].”<sup>16</sup> Conversely, a study in Philadelphia found that consumers living in low-income neighborhoods faced greater price increases for both regular soda and diet soda in their neighborhood stores once the SSB tax was implemented.<sup>24</sup> Specifically, “compared with stores at the 25<sup>th</sup> percentile of the distribution of neighborhood poverty, stores in the 75<sup>th</sup> percentile raised their prices of regular soda by an extra 0.287 cents per ounce [i.e., 19% of the tax amount].”<sup>24</sup> Another study of Philadelphia found similar results, noting differences were statistically significant although relatively small in magnitude.<sup>21</sup> These results indicate SSB taxes “could be regressive not only because it represents a higher percentage of low-income people's income but

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<sup>A</sup> For comparison across studies, researchers presented amounts in \$US using 2015 conversion rates.

also because the stores in which they shop raise prices more [on some or all products] in response to the tax.”<sup>24</sup> Researchers noted the overall distributional impacts of SSB taxes require an understanding of “possible changes in health outcomes for individuals with different level of income and the benefits of the programs funded by the tax revenues.”<sup>24</sup> See the discussion of impacts of tax revenue in Other Considerations on page 17.

Based on data from the 2019 Behavioral Risk Factor Surveillance System (BRFSS) survey in Washington State, SSB consumption was generally higher among individuals with lower incomes compared to individuals with annual incomes over \$100 thousand.<sup>40</sup> For example, 79% of individuals with annual incomes between \$10-\$15 thousand reported drinking SSBs in the past 30 days compared to 67% of individuals with annual incomes above \$100 thousand.<sup>40</sup> Individuals with incomes below \$50 thousand reported consuming significantly more SSBs in the past 30 days than individuals with incomes above \$50 thousand (24.7 vs 17.5).<sup>40</sup>

There is a large body of robust evidence that supports the association between income, or socioeconomic status, and health. A report by the U.S. Agency for Healthcare Research and Quality stated, “more than half of measures show that [low-income] households have worse care than high-income households” and that “significant disparities continue for people [with low-incomes] compared with high-income people who report they were unable to get or were delayed in getting needed medical care due to financial or insurance reasons.”<sup>44</sup> Significant correlations exist between lower income and a number of health indicators including worse overall self-reported health, depression, asthma, arthritis, stroke, oral health, tobacco use, women’s health indicators, health screening rates, physical activity, and diabetes.<sup>45</sup> Further, 2015 data indicate that age-adjusted death rates were higher in Washington census tracts with higher poverty rates.<sup>46</sup> Household income was the strongest predictor of self-reported health status in Washington in 2016, even after accounting for age, education, and race/ethnicity.<sup>47</sup> Among children, evidence indicates that low socioeconomic status in the first five years of life has negative health outcomes in later childhood and adolescence, including activity-limiting illness, parent-reported poor health status, acute and recurrent infections, increasing body mass index (BMI), dental caries, and higher rates of hospitalization.<sup>48</sup>

#### *Inequities by race/ethnicity*

This review also found conflicting evidence as to how implementing a tax would impact communities of color. A study in Oakland found “smaller declines in the availability of taxed beverages (particularly regular soda) for stores with relatively high percentages of local residents that are African American and larger declines for water.”<sup>16</sup> However, African American consumers decreased purchase of SSBs in Oakland, relative to comparison stores in other cities, by 28.18 ounces per shopping trip and increased purchases of other, untaxed beverages by 30.1 ounces per shopping trip.<sup>16</sup> Evidence presented in the study also showed “larger declines in availability of taxed and untaxed (particularly among untaxed) beverages in stores with relatively high percentages of local residents that are Hispanic.”<sup>16</sup> Meanwhile, a Philadelphia study did not find statistically significant differences in pass-through or product availability by the proportion of neighborhood residents who were African American or Hispanic.<sup>24</sup>

The 2011-2014 National Health and Nutrition Examination Survey (NHANES) data suggest that individuals of color consume higher levels of sugar sweetened beverages than their white



counterparts.<sup>39,49</sup> Data showed that SSBs contributed to the highest proportion of total daily calories for individuals identifying as Black (8.3% of total daily calories for Black men; 8.9% for Black women) and as Hispanic (8.1% of total daily calories for Hispanic men; 7.4% for Hispanic women) compared to whites (6.4% of total daily calories for white men; 5.4% for white women).<sup>49</sup> While the percentage of total daily calories from SSBs was similar for Black, white, and Hispanic boys (approximately 7%), Black girls consumed a significantly higher percentage of total daily calories from SSBs than Hispanic girls or Black boys (8.9% compared to 6.8% and 7.9%, respectively).<sup>39</sup>

Washington State 2019 BRFSS data also suggested that individuals of color report higher consumption of SSBs than their white counterparts.<sup>40</sup> Individuals who identified as American Indian or Alaska Native had the highest prevalence of SSB consumption (81%) and the highest average consumption rate (36.1 drinks in the past 30 days) than any other racial/ethnic group in Washington State.<sup>40</sup>

In addition, it is well-documented that communities of color experience worse health outcomes than their counterparts for many health measures. A report by University of California Berkeley's Henderson Center for Social Justice stated, "overall, people of color rate their health status lower than [non-Hispanic] [w]hites...In general, people of color report less access to health care and poorer quality health care than [non-Hispanic] [w]hites."<sup>50</sup> In Washington, data indicate that AI/AN, Native Hawaiian and Other Pacific Islander, and Black residents experience a variety of health inequities compared to other groups in the state, including higher age-adjusted death rates and shorter life expectancies at birth.<sup>46,51-55</sup> Further, communities of color also have higher rates of tobacco use, diabetes, obesity, and poorer self-reported health and mental health.<sup>46,56-60</sup> Specifically, AI/AN people in Washington experience high rates of coronary heart disease deaths,<sup>51</sup> stroke deaths,<sup>55</sup> prevalence of diabetes,<sup>58</sup> and poor mental health than other racial and ethnic groups.<sup>61</sup>

As pass-through rates vary (e.g., by store type or location, product), consumers' price elasticity of demand differs, cross-border shopping has not been evaluated on a state-level, and consumption is difficult to measure, it is unclear whether communities disproportionately impacted by adverse health outcomes associated with SSB consumption would be more likely to reduce consumption of these products if distributors are required to pay an excise tax. Overall, there has not been a large enough body of evidence established to determine how a tax on distributors of sweetened beverages may impact different subpopulations and communities in Washington State, and the impact on health inequities is unclear.

### **Other considerations**

This Health Impact Review focused on the most direct pathway between provisions in the bill and health outcomes and health equity. Evidence for other potential pathways are discussed below.

#### *Impacts on labor and employment*

We explored the potential impact of a tax on sweetened beverages on businesses and employment. There is limited research evaluating this relationship. In one of the only studies and the first in the U.S. to empirically evaluate unintended economic impacts of an excise tax on

SSBs, authors found “no evidence that [Philadelphia’s sweetened beverage tax] resulted in job losses in the overall economy, private sector, limited-service restaurants, or convenience stores” up to two and a half years after the tax was implemented.<sup>62</sup> However, the study was unable to assess impacts to beverage manufacturers or grocery stores; to hours worked or wages; or to types of jobs available (e.g., shifts from higher paying jobs to lower-paying jobs).<sup>62</sup> Key informants familiar with the impacts of Seattle’s Sweetened Beverage Tax shared that evidence suggests that employment was not impacted after the city’s tax was implemented (personal communications, February 2021).

Since there is limited evidence examining the impact of a sweetened beverage tax on labor and employment and since existing research has found no evidence of job losses, we did not include this pathway in the logic model.

#### *Impacts of tax revenue*

SB 5371 stipulates how the revenue from the tax on sweetened beverages must be invested. For Fiscal Year (FY) 2023 (the first full year after implementation), the Department of Revenue projects that a tax on sweetened beverages would likely generate \$220.9 million.<sup>36</sup> Estimates project that the revenue from the tax will increase over the next 10 years, and revenue from the tax on sweetened beverages will total approximately \$2.6 billion from FY 2022 through FY 2031.<sup>36</sup>

Forty percent of revenue from the tax on sweetened beverages must be deposited into the Foundational Public Health Services account. [RCW 43.70.512](#) (Public health system—Foundational public health services—Intent) states that the governmental public health system (comprised of the State Department of Health, State Board of Health, local health jurisdictions, sovereign tribal nations, and Indian health programs) is responsible for delivering a set of core public health services “in ways that maximize the efficiency and effectiveness of the overall system, make best use of the public health workforce and evolving technology, and address health equity.” Funding is allocated to invest in the control of communicable diseases and other notifiable conditions; chronic disease and injury prevention; environmental public health; maternal, child, and family health; access to and linkages with medical, oral, and behavioral health services; vital records; and other capabilities (e.g., public health emergency planning, communications, policy development and support, community partnership development, business competencies) ([RCW 43.70.515](#)). Department of Revenue predicts that the revenue from the tax on sweetened beverages would deposit about \$90.5 million into the Foundational Public Health Services account for FY 2023.<sup>36</sup>

Sixty percent of revenue from the tax on sweetened beverages must be deposited into a health equity account, and bill language requires funds to be used to address social determinants of health in disproportionately impacted communities burdened by negative health outcomes with a focus on access to healthy foods, reducing food insecurity, access to healthcare, and supporting community infrastructure and capacity. Department of Revenue predicts that the revenue from the tax on sweetened beverages would deposit \$135.7 million into the new health equity account for FY 2023.<sup>36</sup>

Unpublished research examining how revenue has been invested across all 7 U.S. jurisdictions with a tax on SSB found that, “over 90% of SSB tax-revenue investments directly support community health and develop human and community capital, and that the majority of funds are being invested in marginalized communities, which bear a disproportionate burden from diseases associated with sugary drinks.”<sup>63</sup> Moreover, “these investments may yield additional health benefits beyond those resulting from lower SSB consumption” and may further advance equity as “allocations reflected interest in racial, social, and health equity, with 83% of funds directed toward benefitting populations affected by inequities.”<sup>63</sup> Lastly, in Seattle, which specified the intent of how revenue was invested, 88% of revenue was used as intended.<sup>63</sup> In 2019, City of Seattle’s Sweetened Beverage Tax provided \$18.3 million, which was invested to support healthy food access (53%), children’s health and early learning (43%), and tax administration (4%).<sup>8</sup>

In the fiscal note for SB 5371, the Office of State Treasurer reported that, “cash flows are currently unavailable; therefore, estimated earnings from investments are indeterminable.”<sup>36</sup> Since the impact on disproportionately impacted communities is dependent on the amount of funding available and on how funds are allocated, we did not include this pathway in the logic model. However, available evidence suggests that, if tax revenue is invested to address social determinants of health in disproportionately impacted communities, there is the potential that SB 5371 could have a greater impact on improving health outcomes and decreasing health inequities.

## Annotated References

1. **Excise Tax.** Available at: <https://www.irs.gov/businesses/small-businesses-self-employed/excise-tax>. Accessed February 17, 2021.

This Internal Revenue Service (IRS) webpage defines excise taxes, as "taxes paid when purchases are made on a specific good [...] Excise taxes are often included in the price of the product. There are also excise taxes on activities."

2. **Heise Thomas L., Katikireddi Srinivasa V., Pega Frank, et al. Taxation of sugar-sweetened beverages for reducing their consumption and preventing obesity or other adverse health outcomes (Protocol).** *Cochrane Database of Systematic Reviews*. 2016.

In this Cochrane Review protocol briefing, Heise et. al. provided background research and outlined plans to examine the relationship between a SSB tax and health outcomes. The intent of the study is "to assess the effects of taxation of SSBs...on [sugar- sweetened beverage] consumption, energy intake, overweight, obesity, and other adverse health outcomes in the general population." The study will evaluate direct and indirect health outcomes as a result of SSB consumption. The protocol noted that, "the primary motivation for taxing SSBs is to decrease the intake of these beverages in the general populations." The authors noted, "empirical evidence is becoming available, based on data from countries or states that have already implemented SSB taxes. This includes research on the association between the existence of state-level soft drink and other high caloric food taxes, and the incidence of obesity." This pending review will fill a gap in the literature synthesizing the impacts of SSB taxes on direct and indirect health outcomes.

3. **Win Thin Lei. With Zumba and tax, Navajo Nation looks to scrap bad diet.** *Reuters*. 24 October 2018, 2018;Big Story 10

This Reuters news article discusses the Navajo Nation's efforts to address factors contributing to tribal members' poor health outcomes (e.g., diabetes). The Navajo Nation is the largest North American tribe with approximately 300,000 enrolled members across parts of Arizona, New Mexico, and Utah. The Navajo became the first government in the U.S. to tax junk food. "The Healthy Diné Nation Act 2014 imposes a 2 percent tax on SSBs and foods high in salt, fat and/or sugar such as chips, candy, pastries and fried foods." The law, which went into effect in 2015, complements another law eliminating a 5% tax on fresh fruits and vegetables. As of October 2018, "the tax has raised more than \$4 million for the Navajo Nation [...] as mandated by the law, revenue has gone toward projects the Navajo define as health and wellness, such as vegetable gardens, craft classes, exercise equipment and walking trails."

4. **Arkansas Soft Drink Tax Act, § 26-57-904 Arkansas Code Annotated(1992).**

This Arkansas State law (Tax Rate) outlines the excise tax levied for the distribution of soft drinks as defined in § 26-57-902(13)(A-B).

5. **Arkansas Soft Drink Tax Act, Arkansas Code Annotated(1992).**

This section of the Arkansas Soft Drink Tax Act directs revenues from the excise tax be credited to the "Arkansas Medicaid Program Trust Fund."

6. **Bleich S. N., Lawman H. G., LeVasseur M. T., et al. The Association Of A Sweetened Beverage Tax With Changes In Beverage Prices And Purchases At Independent Stores. *Health Aff (Millwood)*. 2020;39(7):1130-1139.**

Bleich et al. analyzed compared changes in beverages prices and purchases before and 12 months after Philadelphia, Pennsylvania, implemented an excise tax of 1.5 cents per ounce on beverages sweetened with sugar or artificial sweeteners. Baltimore, Maryland, served as a control as SSBs remained untaxed, for its proximity to Philadelphia (without bordering it), and its population having a similar demographic profile. This was the first study to focus on small independent stores, which serve as an "important yet understudied setting" as they are "visited frequently in urban and low-income areas, and sugary beverages are among the most commonly purchased items in them." The study's secondary aims were to "examine differences by beverage sweetener status and container size, income levels in stores' neighborhoods, and customers' education levels." The sample included 134 stores with price data and 4,584 customer purchases (purchased during week days, limiting the generalizability of findings). "Compared with Baltimore, Philadelphia experienced significantly greater increases in the price of taxed beverages (1.81 cents per ounce, or 120.4 percent of the tax) and significantly larger declines in the volume of taxed beverages sold (5.76 ounces, or 38.9 percent) after tax implementation." Authors concluded that "beverage excise taxes may be an effective policy tool for decreasing the purchase of sweetened drinks in small independent stores, particularly among populations at higher risk for [SSB] consumption [i.e., people with lower income or educational attainment]."

7. **Council Seattle City. AN ORDINANCE imposing a tax on engaging in the business of distributing sweetened beverages; adding a new Chapter 5.53 to the Seattle Municipal Code; and amending Seattle Municipal Code Sections 5.30.010, 5.30.025.K, 5.30.060.C, 5.55.010, 5.55.040.A, 5.55.060.A, 5.55.150.E, 5.55.165, 5.55.220, and 5.55.230.A. 3 ed. Seattle, WA: Seattle City Clerk; 2017.**

In June 2017, the Seattle City Council passed amended Council Bill 118965 creating City of Seattle Ordinance 125324 which established the city's Sweetened Beverage Tax. The tax went into effect January 1, 2018.

8. **Seattle City of. Sweetened Beverage Tax. *Supporting healthy food and child health and development*. Seattle, WA2019.**

This City of Seattle fact sheet provides an overview of the city's Sweetened Beverage Tax. It discusses why Seattle passed the tax (of 1.75 cents per ounce) on SSB products. It notes that a 20 oz soda has 15 teaspoons of added sugar 250 empty calories. Drinking 1 to 2 cans a day increases risk of Type 2 Diabetes by 26%. Beverages that are taxed under the ordinance include regular sodas, fruit drinks (excluding 100% juice), energy and sports drinks, sweetened waters, sweetened coffees and teas, and syrups and concentrates. Diet drinks, bottled water, 100% juice, milk (including plant-based), powders and concentrates mixed by the end consumer, beverages for medical use, infant or baby formula, and alcoholic beverages are not taxed. Revenues from the tax are directed to support and expand programs that increase access to healthy food (53%) and to support child health, development, and readiness for school (43%). Additionally, 4% of revenues support the administration of the Sweetened Beverage Tax Community Advisory Board and to fund a 5-year evaluation to study the effects of the tax on economic outcomes and health behaviors. In 2019, the Sweetened Beverage Tax provided \$18.3 million to support these efforts.

9. **Agriculture U.S. Department of. Dietary Guidelines for Americans 2015-2020 (Eighth Edition).2015.**

The 2015-2020 Dietary Guidelines for Americans (published by the U.S. Department of Agriculture) recommended that added sugars should make up less than 10% of total calories per day. In addition, the guidelines suggest choosing beverages with no added sugars. Specifically, “choosing beverages with no added sugars, such as water, in place of [SSBs], reducing portions of [SSBs], drinking these beverages less often, and selecting beverages low in added sugars.” The guidelines noted that [SSBs] are one of the main sources of added sugars in U.S. diets, accounting for 47% of the dietary sources of added sugars for individuals aged 2 years and older.

10. **Cawley J. , Frisvold D.E. . The Pass-Through of Taxes on Sugar-Sweetened Beverages to Retail Prices: The Case of Berkeley, California. *Journal of Policy Analysis and Management*. 2017;36(2):303-326.**

Cawley and Frisvold estimate the extent to which Berkeley's tax on SSBs is passed through to consumers in the form of higher prices. Authors collected the "prices of various brands and sizes of SSBs and other beverages before and after the implementation of the tax from a near-census of convenience stores and supermarkets in Berkeley, California" as well as prices from stores in a San Francisco (i.e., control city). Results found "estimates from difference-in-differences models indicate that, across all brands and sizes of products examined, 43.1 percent (95 percent confidence interval: 27.7 to 58.4 percent) of the Berkeley tax was passed on to consumers." Estimates were consistent with cross-border shopping. Specifically, "For each mile of distance between the store and the closest store selling untaxed SSBs, pass-through rose 33.3[%] for 2 [liter] bottles and 25.8% for 12-packs of 12 ounce cans."

11. **Chriqui Jamie F., Powell Lisa M. Sugar-Sweetened Beverage Taxes: Increasing Prices to Reduce Beverage Consumption. *American Journal of Public Health*. 2020;110(7):931-932.**

This Editorial by Chriqui and Powell provides context for the research assessing SSB taxes using Falbe et al.'s July 2020 AJPH article as an example. Authors discuss the differences in assessing beverage tax pass-through using different data sources (i.e., store audit versus scanner data) and the benefits and limitations to each. They also discuss lessons learned by evaluating taxes that have been implemented and resulting pass-through. They conclude that available evidence from Falbe et al. and other studies is the need to continue investigating differences in tax pass-through across store types and locations and to understand whether retailers may increase prices of both taxed and untaxed beverages. Furthermore, they highlight that "multiple studies based on different sources of data are valuable as each will contribute to a broader understanding of the impacts of such taxes."

12. **Cawley J., Thow A. M., Wen K., et al. The Economics of Taxes on Sugar-Sweetened Beverages: A Review of the Effects on Prices, Sales, Cross-Border Shopping, and Consumption. *Annu Rev Nutr*. 2019;39:317-338.**

This review by Cawley et al. outlines the economic rationale for SSB taxes, illustrates their predicted effects, and reviews available research on the effects of SSB taxes on retail prices, sales, cross-border shopping, consumption, and product availability. The review identified three studies examining SSB taxes on sales by stores in Berkeley and one in Philadelphia. A study by Rojas and Wang (2017) failed to reject the null hypothesis of no impact on average monthly

volume of sales of SSBs or sodas. The other two studies (Silver 2017 and Bollinger & Sexton 2018) estimated reductions in sales among supermarket chains analyzed (i.e., estimated reductions of 9.6% in taxed ounces per transaction and 7-12% reduction of SSB sales, respectively). Bollinger and Sexton also examined purchases among one pharmacy chain in Berkeley and could not reject the null hypothesis of no change in sales in this setting. In another study, consumer surveys were used to estimate the impact of Philadelphia's 2 cents per ounce beverage tax on consumers' purchases. Researchers interviewed different sets of customers before and after the tax was implemented at both stores in Philadelphia and control areas nearby. "They estimated that the tax reduced purchases of taxed beverages in Philadelphia by 8.9 ounces per shopping trip." Overall, "evidence indicates that the amount by which taxes increase retail prices (also called the pass-through of the tax) varies by jurisdiction, ranging from less than 50% to 100% of the tax. Sales tend to decrease significantly in the taxing jurisdiction, although this seems to be partly offset by residents increasingly shopping outside of the taxing jurisdiction (i.e., engaging in cross-border shopping)." Finally, authors found that while "overall taxes lower consumption of the taxed beverages by adults," this does not hold true for all types of beverages or all groups of consumers. They provide suggestions for improving the design of such taxes and directions for future research.

**13. Falbe J. , Rojas N. , Grummon A.H. , et al. Higher Retail Prices of Sugar-Sweetened Beverages 3 Months After Implementation of an Excise Tax in Berkeley, California. *American Journal of Public Health*. 2015;105(11).**

Falbe et al. assessed the short-term ability to increase retail prices using a 1-cent-per-ounce excise tax on the distribution of SSBs implemented in Berkeley, California in March 2015. Authors examined pre- to posttax price changes for SSBs and non-SSBs in a variety of retailers in Berkeley (intervention site) and two comparison, control cities (San Francisco and Oakland). Researchers examined price changes by beverage, brand, size, and retailer type. Overall, the price of smaller beverages (less than or equal to 33.8 oz.) increased 0.69 (cents/oz) in Berkeley relative to comparison cities (95% confidence interval = 0.36-1.03) for soda. Prices also increased for small sized fruit-flavored drinks (0.47 [95% CI = 0.08, 0.87]) and SSBs overall (0.47 [95% CI = 0.25, 0.69]). The price for 2-liter bottles and multipacks of sodas also increased in relative price. "For other retailers, pass-through for soda ranged from 0.59 cents per ounce (95% CI = 0.05, 1.01) for small grocery stores to 1.35 cents per ounce (95% CI = -0.40, 3.10) for liquor stores." For SSBs overall, pass-through ranged from "0.42 cents per ounce (95% CI = 0.00,0.85) in small grocery stores to 0.97 cents per ounce (95% CI = 0.43, 1.51) in liquor stores." Additionally, "Pass-through estimates for these beverages, which we assessed only in supermarkets and drugstores, were similar to the pass-through for 20-ounce bottles sold in supermarkets and drugstores (0.37 cents/oz; 95% CI = 0.13, 0.60). However, when considering promotional prices, the pass-through for 2-liter bottles dropped to 0.24 cents per ounce (95% CI = -0.46, 0.94), whereas passthrough for multipacks became 0.56 cents per ounce (95% CI = -0.21, 1.34)."

**14. Roberto Christina A., Lawman Hannah G., LeVasseur Michael T., et al. Association of a Beverage Tax on Sugar-Sweetened and Artificially Sweetened Beverages With Changes in Beverage Prices and Sales at Chain Retailers in a Large Urban Setting. *Jama*. 2019;321(18).**

Roberto et al. compared changes in beverage prices and sales in Philadelphia, Pennsylvania, following the implementation of the city's SSB tax compared with prices in Baltimore, Maryland ( a control city without a tax). The main outcomes considered were change in taxed beverage prices and volume sales. A secondary aim was to assess potential cross-border shopping as a means to avoid the tax. Authors used "a difference-in-differences approach and analyzed sales data to compare changes between January 1, 2016, before the tax, and December 31, 2017, after the tax. Differences by store type, beverage sweetener status, and beverage size were examined." Overall, 291 stores (54 supermarkets, 20 mass merchandisers, and 217 pharmacies) were analyzed. Results show that "compared with Baltimore, Philadelphia experienced significantly greater increases in taxed beverage prices and significantly larger declines in volume of taxed beverages sold in the after-tax period." Authors calculated the % of the tax passed through to consumers for supermarkets (43.1%), mass merchandise stores (57.8%), and pharmacies (104.%). Although total volume sales of taxed beverages in Philadelphia decreased by 51.0% after tax implementation, cross-border shopping offset this decrease in Philadelphia's volume sales by 24.4%.

**15. Silver L. D., Ng S. W., Ryan-Ibarra S., et al. Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: A before-and-after study. *PLoS Med.* 2017;14(4):e1002283.**

Silver et al. examine the association between the Berkeley, California, 1 cent per ounce tax on SSBs with beverage prices, sales, store revenue/consumer spending, and usual beverage intake. Authors compare pre-taxation (before 1 January 2015) and first-year post-taxation (1 March 2015-29 February 2016) "measures of (1) beverage prices at 26 Berkeley stores; (2) point-of-sale scanner data on 15.5 million checkouts for beverage prices, sales, and store revenue for two supermarket chains covering three Berkeley and six control non-Berkeley large supermarkets in adjacent cities; and (3) a representative telephone survey (17.4% cooperation rate) of 957 adult Berkeley residents." The main outcomes and measures of interest include "changes in inflation-adjusted prices (cents/ounce), beverage sales (ounces), consumers' spending measured as store revenue (inflation-adjusted dollars per transaction) in two large chains, and usual beverage intake (grams/day and kilocalories/day)." Authors observed that tax pass-through (i.e., changes in the price after implementation of the tax) varied in degree and timing by store type and beverage type. Results pass-through was "complete in large chain supermarkets (+1.07 cent/oz,  $p = 0.001$ ) and small chain supermarkets and chain gas stations (1.31 cent/oz,  $p = 0.004$ ), partial in pharmacies (+0.45 cent/oz,  $p = 0.03$ ), and negative in independent corner stores and independent gas stations (-0.64 cent/oz,  $p = 0.004$ )." Results showed that post-tax year 1 SSB sales (ounces/transaction) declined 9.6% ( $p < 0.001$ ) in Berkeley stores compared to estimates if the tax were not in place, but rose 6.9% ( $p < 0.001$ ) for non-Berkeley stores. Meanwhile, sales of untaxed beverages in Berkeley stores rose (3.5%) compared to non-Berkeley stores (0.5%) (both statistically significant  $p < 0.001$ ). Overall beverage sales (e.g., water, untaxed fruit, vegetable, and tea drinks, plain milk) also rose across stores. "Scanner data mean store revenue/consumer spending (dollars per transaction) fell 18 cent less in Berkeley (-\$0.36,  $p < 0.001$ ) than in comparison stores (-\$0.54,  $p < 0.001$ ). Berkeley's baseline and post-tax SSB "sales and usual dietary intake were markedly low compared to national levels (at baseline, National Health and Nutrition Examination Survey [SSB] intake nationally was 131 kcal/d and in Berkeley was 45 kcal/d)." Reductions in self-reported mean "daily intake in grams (-19.8%,  $p = 0.49$ ) and in mean per capita SSB caloric intake (-13.3%,  $p = 0.56$ ) from baseline to post-tax were not statistically



significant." Authors noted study limitations included an inability to establish causal links due to observational design and the absence of health outcomes. Additionally, "analysis of consumption was limited by the small effect size in relation to high standard error and Berkeley's low baseline consumption." Authors concluded that one year after the implementation Berkeley's tax, prices of SSBs increased in many, but not all, settings; sales declined; and "sales of untaxed beverages (especially water) and overall study beverages rose in Berkeley; overall consumer spending per transaction in the stores studied did not rise. Price increases for SSBs in two distinct data sources, their timing, and the patterns of change in taxed and untaxed beverage sales suggest that the observed changes may be attributable to the tax." Finally, post-tax self-reported consumption did not change significantly compared to baseline. Authors stated, "Significant declines in SSB sales, even in this relatively affluent community, accompanied by revenue used for prevention suggest promise for this policy. Evaluation of taxation in jurisdictions with more typical SSB consumption, with controls, is needed to assess broader dietary and potential health impacts."

**16. Cawley J., Frisvold D., Hill A., et al. Oakland's sugar-sweetened beverage tax: Impacts on prices, purchases and consumption by adults and children. *Econ Hum Biol.* 2020;37:100865.**

Cawley et al. estimate the impact of Oakland's 1 cent tax per ounce on retail prices, product availability, purchases, and child and adult consumption of taxed beverages, as well as of potential substitute beverages. Authors "collected data from Oakland stores and their customers and a matched group of stores in surrounding counties and their customers." Information collected in the months prior to the implementation of the tax and again a year later included: "(1) prices, (2) purchase information from customers exiting the stores, and (3) a follow-up household survey of adults and child beverage purchases and consumption." Using a difference-in-differences identification strategy to estimate the impact of the tax on prices, purchases, and consumption of taxed beverages, authors found approximately 60% of the tax was passed on to consumers in the form of higher prices. However, pass-through varied by "store type, the container size of the beverage, distance and time to the closest untaxed competitor, and the characteristics of the local populations living near the stores." Results also showed a "slight decrease in the volume of SSBs purchased per shopping trip in Oakland and a small increase in purchases at stores outside of the city." The resulting decrease in purchases (11.33 ounces per shopping trip) was not statistically significant. There was evidence of increased shopping by Oakland residents at stores outside of the city. Authors concluded, that evidence did not indicate substantial changes in the overall consumption of SSBs or of added sugars consumed through beverages for either adults or children after the tax.

**17. Saelens B.E., Rowland M., Qu P., et al. 12 Month Report: Store Audits & Child Cohort - The Evaluation of Seattle's Sweetened Beverage Tax. Report for City of Seattle and Seattle City Council. 2020.**

This report summarizes findings from data collected 12 months after the implementation of Seattle's Sweetened Beverage Tax. Researchers conducted "surveys of beverage prices in stores and restaurants and surveys with lower-income children and parents before, six months after, and 12 months after tax implementation to assess whether the tax is passed on to consumers via higher retail prices of taxed beverages." Prior to the implementation of the tax and study, it was unknown whether distributors would pass the cost of the excise tax to retailers and from retailers to consumers through price increases. "To attempt to isolate the effect of the tax, we compared

changes in Seattle to any changes seen in the comparison area of Federal Way, Kent, and Auburn (where no [SSB] tax was in effect)." Methods included store audits at 12 month (with surveys of 25,756 beverages within 386 stores or restaurants) and the family surveys at 12 months (with 315 children and parents with lower incomes). Overall, the study found that "the tax on sugary beverages incurred by distributors is being passed through to consumers" one year after implementation. The study also found, "lower-income children and parents living in Seattle who were part of our sample reduced sugary beverage consumption from before to after the Sweetened Beverage Tax implementation. Unexpectedly, the reductions observed among Seattle families were similar to reductions observed among comparison area families over the one-year period." Authors noted, "These findings could be the result of general norms and trends in sugary beverage consumption, limitations in our measurement of beverage consumption, or other unknown factors affecting beverage consumption among lower-income families in our region."

**18. Bollinger B. , Sexton S.E. . Local Excise Taxes, Sticky Prices, and Spillovers: Evidence from Berkeley's Soda Tax. *Social Science Research Network Electronic Journal*. 2018.**

Bollinger and Sexton evaluate the price and consumption effects of Berkeley, CA, soda tax using high-resolution scanner data. They "estimate the tax had no effect on prices or consumption at drugstores, but modestly increases supermarket prices of some soda products, constituting a minority of soda consumption. They found "limited evidence of reduced supermarket purchases of soda in the taxed jurisdiction" and half of the reduction in purchases were substituted to just outside the taxed jurisdiction.

**19. Powell L. M., Leider J. Evaluation of Changes in Beverage Prices and Volume Sold Following the Implementation and Repeal of a Sweetened Beverage Tax in Cook County, Illinois. *JAMA Netw Open*. 2020;3(12):e2031083.**

Powell and Leider used an interrupted time series analysis to assess changes in price and volume of taxed and untaxed sweetened beverages in Cook County, Illinois, following the implementation and repeal of the county's Sweetened Beverage Tax (SBT) compared to St Louis County and City, Missouri (control site). Cook County implemented the SBT on August 2, 2017 and repealed the tax effective December 1, 2017. Authors used Nielsen food store scanner data to assess changes in taxed and untaxed beverage prices and volume sold for each site in supermarkets and mass merchandise, grocery, drug, convenience, and dollar stores. "The analytic samples included 16,510 UPCs for volume and 2,141 UPCs (balanced sample) for prices for 122 pretax weeks, 16 tax weeks, and 35 postrepeal weeks." Compared to the control county, Cook County's posttax implementation resulted in an increase in taxed beverage prices (1.13 cents per fluid ounce [95% CI, 1.01 to 1.25 cents per fluid ounce). Following the repeal, the price decreased by -1.19 cents per fluid ounce, (95% CI, -1.33 to -1.04 cents per fluid ounce). Prices decreased to their pretax level following the repeal. Meanwhile, "Volume sold of taxed beverages in Cook County compared with St Louis exhibited a posttax implementation level decrease of 25.7% ( $\beta = -0.297$ ; 95%CI,  $-0.415$  to  $-0.179$ ) and a posttax repeal level increase of 30.5% ( $\beta = 0.266$ , 95% CI, 0.124 to 0.408), with no net change in volume sold from pretax to 8 months after repeal." The results indicate that repealing of SBT "may fully reverse their associations with reduced demand and harms associated with sweetened beverage intake."

20. **Powell L. M., Leider J. The impact of Seattle's Sweetened Beverage Tax on beverage prices and volume sold. *Econ Hum Biol.* 2020;37:100856.**

Powell and Leider used universal product code-level store scanner data and a pre-post intervention-comparison site difference-in-differences study design to assess the impact of Seattle's Sweetened Beverage Tax (SBT) on taxed beverage prices in the city, the volume sold of taxed beverages in Seattle and in its 2-mile border area (cross-border shopping), and the volume sold of untaxed beverages (substitution) relative to changes in its comparison site of Portland, OR. The results of the difference-in-differences design showed that, "on average, in the first year post-tax implementation, prices of taxed beverages rose by 1.03 cents per oz ( $p < 0.001$ ) corresponding to a 59% tax pass-through rate. Volume sold of taxed beverages fell, on average, by 22% ( $p < 0.001$ ) in the first year following the implementation of the tax." Specifically, "volume sold of taxed beverages fell to a greater extent for family- versus individual-size beverages (31% versus 10%) and fell to a greater extent for soda (29%) compared to all other beverage types." Results indicate moderate substitution to untaxed beverages (4% increase in volume sold,  $p < 0.05$ ). Finally, "the results revealed no significant increases in the overall volume sold of taxed beverages in the 2-mile border area of Seattle relative to its comparison site suggesting that tax avoidance in the form of cross-border shopping did not dampen the impact of the tax."

21. **Seiler S. , Tuchman A. , Yao S. . The Impact of Soda Taxes: Pass-Through, Tax Avoidance, and Nutritional Effects. *Journal of Marketing Research.* 2020;58(1):22-49.**

Seiler et al. analyzed the impact of a tax on sweetened beverages using a unique data set (i.e., retail point-of-sale data collected by IRI, a large market-research firm) of prices, quantities sold, and nutritional information across 17,582 taxed and untaxed beverages for a large set of stores in Philadelphia (357) and the surrounding area (870). Authors calculated the average tax passed-through rate was 97% (range 77% to 119%, with two exceptions), leading to a 34% price increase. Authors found the price increase in percentage terms was "somewhat lower in convenience stores and drugstores, despite a similar pass-through rate [...] because those retail formats tend to sell smaller pack sizes, which, on average, have a higher price per ounce." Overall, "demand in the taxed area decreases by 46% in response to the tax." Specifically, chains that sold large quantities prior to the tax--namely, grocery stores, mass merchants, wholesale clubs--all experience large decreases in sales of 41-69%." Meanwhile, "drugstores and convenience stores experienced more modest decreases or no decrease in volume sold." Authors hypothesize: 1) the price increased less in percentage terms at these locations due to a higher pretax price level and 2) these stores tend to sell smaller packages meant for immediate consumption, in which consumers may be less price sensitive. However, "cross-shopping to stores outside of Philadelphia offsets more than half of the reduction in sales in the city and decreases the net reduction in sales of taxed beverages to only 22% [statistically significant decrease at the 5% level]." The analysis found no significant substitution to bottled water and modest substitution to untaxed natural juices. Results showed that quantities purchased decreased by approximately 10% more in the highest-income area relative to the lowest-income area. Authors discuss "several pieces of evidence that suggest that the reason demand decreases less in low-income areas is because low-income households face higher transportation costs." Authors conclude that tax avoidance through cross-shopping severely constrained revenue generation and nutritional improvement, thus making geographic coverage an important policy decision.

22. **Cawley J., Frisvold D., Hill A., et al. The impact of the Philadelphia beverage tax on purchases and consumption by adults and children. *J Health Econ.* 2019;67:102225.**

Cawley et al. examined the effects of Philadelphia's sweetened beverage tax of 1.5 cents per ounce. They surveyed adults and children in the city as well as nearby comparison communities both before the tax and nearly one year after implementation. Like other studies, authors found that pass-through of the tax varied by store type, with the greatest pass through occurring in convenience stores with gas stations. Additionally, results showed the "tax reduced purchases in Philadelphia stores and that Philadelphia residents increased purchases of taxed beverages outside of the city." Researcher observed tax reduced the frequency of adults' soda consumption by 31% but had "no detectable impacts on adults' consumption of other beverages." Meanwhile, "the tax had no detectable impact on children's consumption of soda or all taxed beverages, although children who were frequent consumers prior to the tax reduced their consumption after the tax."

23. **Teng A. M., Jones A. C., Mizdrak A., et al. Impact of sugar-sweetened beverage taxes on purchases and dietary intake: Systematic review and meta-analysis. *Obes Rev.* 2019;20(9):1187-1204.**

Teng et al. conducted a systematic review of real-world SSB tax evaluations from across the world and a meta-analysis to examine the overall impact of such taxes on beverage purchases and dietary intake. Articles were identified through Medline, EconLit, Google Scholar, and Scopus databases via search up to June 2018. "SSB tax evaluations from any formal jurisdiction from cities to national governments were eligible if there was a comparison between pre-post tax (n = 11) or taxed and untaxed jurisdiction(s) (n = 6). The consumption outcome comprised sales, purchasing, and intake (reported by volume, energy, or frequency)." Researchers evaluated taxed and untaxed beverage consumption outcomes separately by meta-analysis and adjusted for the size of each tax. Overall, results of the meta-analysis showed "the equivalent of a 10% SSB tax was associated with an average decline in beverage purchases and dietary intake of 10.0% (95% CI: -5.0% to -14.7%, n = 17 studies, 6 jurisdictions) with considerable heterogeneity between results ( $I^2 = 97%$ )." Additionally, "the equivalent of a 10% SSB tax was also associated with a nonsignificant 1.9% increase in total untaxed beverage consumption (eg, water) (95% CI: -2.1% to 6.1%, n = 6 studies, 4 jurisdictions)." Authors concluded that real-world evaluations indicated that "SSB taxes introduced in jurisdictions around the world appear to have been effective in reducing SSB purchases and dietary intake."

24. **Cawley J., Frisvold D., Hill A., et al. The Impact of the Philadelphia Beverage Tax on Prices and Product Availability. *Journal of Policy Analysis and Management.* 2020;39(3):605-628.**

Cawley et al. examine the affect of Philadelphia's beverage tax, enacted in 2017, on the prices and availability of both taxed and untaxed beverages. Using original data collected in late 2016 and again one year later, authors "estimate difference-in-differences regressions of the change over time in beverage prices and availability in stores in Philadelphia relative to stores in nearby [control] counties." Store types included: stand alone convenience stores, gas stations with convenience sotres, small grocery stores, pharmacies, warehouse stores, and large grocery stores. Results show, on average, distributors and retailers fully passed through the tax to consumers and that pass-through was higher for individual servings than for larger sizes. Authors found "heterogeneity in the pass-through rate among stores; it is greater among stores that are in higher

poverty neighborhoods, located farther from untaxed stores outside Philadelphia, and that are independent as opposed to part of national chains." Furthermore, evidence indicates the "tax reduced the availability of taxed beverages and increased the availability of untaxed beverages, particularly bottled water, in Philadelphia stores."

25. **Zhong Y. , Auchincloss A.H., Lee B.K., et al. The Short-Term Impacts of the Philadelphia Beverage Tax on Beverage Consumption. *American Journal of Preventive Medicine*. 2018;55(1):26-34.**

Zhong et al. used a repeated cross-sectional design to evaluate the immediate impact of Philadelphia's sweetened beverage tax on residents' consumption of soda, fruit drinks, energy drinks, and bottled water. Data from a random-digit-dialing phone survey (50% from cell phones) immediately before the tax was implemented and shortly after the tax was implemented. Respondents included 899 Philadelphia, PA, residents and 878 residents of three nearby comparison cities. The response rate was 3%. Philadelphia respondents roughly matched Census population demographics for sex and race, but were slightly older and of higher SES. "Survey questions included frequency and volume of bottled water and beverages. Outcomes were daily consumption, and 30-day consumption frequency and volume." The study's survey instrument did not specifically refer to the beverage tax, thus minimizing social desirability and recall biases. Authors used propensity score-weighted difference-in-differences regression to control for secular time trend and confounding. Specifically, covariates were sociodemographics, BMI, health status, smoking, and alcohol use. Results show that "Within the first 2 months of tax implementation, relative to the comparison cities, in Philadelphia the odds of daily consumption of regular soda was 40% lower (OR=0.6, 95% CI=0.37,0.97); energy drink was 64% lower (OR=0.36, 95% CI=0.17, 0.76); bottled water was 58% higher (OR=1.58, 95% CI=1.13, 2.20); and the 30-day regular soda consumption frequency was 38% lower (ratio of consumption frequency=0.62, 95% CI=0.40, 0.98)." While early results suggest the tax influenced daily consumption of regular soda, energy drinks, and bottled water, authors recommend future studies evaluate the longer-term impact of the tax on sweetened beverage consumption and substitutions. Limitation include potential differences between intervention and control groups that were not accounted for among covariates, inability to assess seasonal impacts; low survey response rate; variable pass-through rates and other factors.

26. **Wang E.Y. . The impact of soda taxes on consumer welfare: implications of storability and taste heterogeneity. *RAND Journal of Economics* 2015;46(2):409-441.**

In this article Wang provides estimates of the relevant price elasticities based on a dynamic demand model to "address potential intertemporal substitution and unobservable persistent heterogeneous tastes." The author reviews the related literature, presents industry details and the data, discusses the model and the estimation procedure, and presents empirical results. Finally, the article includes a discussion of welfare implications of SSB taxes. "Long-run price elasticities measure consumers' responsiveness to permanent price changes, and estimate determine the predictions of posttax consumption patterns [...] and influence the resulting welfare loss." The author found "for all taxes at all pass-through levels, [low-income] households experience the largest reduction in consumption and [high income] households the experience the least." Similarly, SSB consumption is highest for low-income households and lowest for high-income households. Overall, the author finds "static analyses overestimate the long-run own-price elasticity of regular soda by 60.8%, leading to overestimated consumption reduction

of sugar-sweetened soft drinks by up to 57.9% in some cases." Wang concludes, "results indicate the soda taxes will raise revenue but are unlikely to substantially impact soda consumption.

**27. Thow A.M. , Downs S. , Jan S. . A systematic reivew of the effectiveness of food taxes and subsidies to improve diets: Understanding the recent evidence. *Nutrition Reviews*. 2014;72(9):551-565.**

Thow et al. conducted a systematic review, including an assessment of study quality, on new evidence published between January 2009 and March 2012 for the effect of food taxes and subsidies on consumption. Forty-three reports representing 38 studies met the inclusion criteria. Sixteen studies modeled the effect of SSB taxes (range 5% to 30%) on consumption. "All showed a reduction in consumption of these beverages, ranging from 5% to 48%, demonstrating overall a response in consumption that was proportional to the taxes applied." Four of the modeling studies considered "substitution between beverages in response to taxes of 5–20% suggested that consumers would reduce consumption of SSBs, reducing caloric intake from these beverages by 10–48% in adults and by 5–8% in children." Three showed "an overall reduction in calorie consumption from all beverages due to these taxes," while one showed no reduction in overall calorie consumption as it estimated children would substitute whole milk for soft drinks. Additionally, 6 studies "that did not consider substitution with other beverages also found significant reductions in consumption of SSBs or soft drinks of 10–25% in response to taxes of 10–30%." Meanwhile, "[3] studies of existing state-based soft drink taxes in the United States showed little difference in consumption between states with small taxes (around 5%) and states without such taxes." However, a study using data from the USA Coronary Artery Risk Development in Young Adults "found that a tax that increased the price of [SSBs] by 10% could reduce consumption by 7%." Another study using data form the Nurses' Health Study estimated a penny-per-ounce tax could reduce soft drink consumption by 15%. In regards to distribution of tax effects, one modeled study from the U.S. "found a [SSB] tax to have negligible differential effects by income group." Four additional modeled studies (including 1 U.S.-based study) found "higher price sensitivity of low-income households meant that they were more likely than high-income households to reduce their consumption in response to a tax." Two modeled studies from the U.S., as well as one from Sweden, reported "the largest share of revenue would come from high-income households because these households were less likely to change their behavior in response to the tax.

**28. Lee M. M., Falbe J., Schillinger D., et al. Sugar-Sweetened Beverage Consumption 3 Years After the Berkeley, California, Sugar-Sweetened Beverage Tax. *Am J Public Health*. 2019;109(4):637-639.**

Lee et al. used a repeated cross-sectional design to estimate changes in SSB and water consumption 3 years after an SSB tax in Berkeley, California, relative to unexposed comparison neighborhoods. Researchers conducted beverage frequency questionnaires from 2014 to 2017 in demographically diverse Berkeley (n = 1513) and comparison (San Francisco and Oakland; n = 3712) neighborhoods. Pretax consumption (2014) was compared with a weighted average of 3 years of posttax consumption. "At baseline, SSBs were consumed 1.25 times per day (95% confidence interval [CI] = 1.00, 1.50) in Berkeley and 1.27 times per day (95% CI = 1.13, 1.42) in comparison city neighborhoods. When we adjusted for covariates, consumption in Berkeley declined by 0.55 times per day (95% CI = -0.75, -0.35) for SSBs and increased by 1.02 times per day (95% CI = 0.54, 1.50) for water." Overall, changes in consumption of SSBs, except energy

drinks, in Berkeley were significantly different from those in the comparison groups, which saw no significant changes. "Reductions in SSB consumption were sustained in demographically diverse Berkeley neighborhoods over the first 3 years of an SSB tax, relative to comparison cities." These persistent, longer-term reductions in SSB consumption suggest that SSB taxes are an effective policy option for jurisdictions focused on improving public health. Authors noted several study limitations, including the convenience sample and unmeasured confounding; that Berkeley is a relatively small city with a highly educated population, potentially limiting generalizability; and self-reported BFQ data are subject to bias (although tool is validated and change estimates are less susceptible to bias than point in time estimates of consumption).

**29. Falbe J., Thompson H.R. , Becker C.M., et al. Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *American Journal of Public Health*. 2016;106(10).**

Falbe et al. conducted a repeated cross-sectional study to examine changes in pre- to posttax beverage consumption in low-income neighborhoods in Berkeley versus the comparison cities of Oakland and San Francisco, California. Authors focused the analysis on low-income neighborhoods with higher populations of people of color who are more likely to consume SSBs and suffer related health consequences. Authors used 2012 census data to select "2 large, low-income neighborhoods that yielded the highest combined proportion of African American and Hispanic residents". According to 2014 census estimates "average household median incomes for these tracts versus the entire city were \$59 000 versus \$65 000 in Berkeley, \$46 000 versus \$53 000 in Oakland, and \$52 000 versus \$78 000 in San Francisco." A beverage frequency questionnaire (BFQ) was administered by an interviewer to 990 participants before the tax and 1689 after the tax (8 months post vote and 4 months post implementation) to examine relative changes in consumption. Results showed that consumption of SSBs decreased 21% in Berkeley and decreased 4% in comparison cities ( $P=0.046$ ). Adjusted consumption of regular soda decreased by 26% in Berkeley and increased by 10% in comparison cities ( $P=0.05$ ), and adjusted consumption of sports drinks decreased by 36% in Berkeley and increased by 21% in comparison communities ( $P=0.02$ ). "Water consumption increased more in Berkeley (+63%) than in comparison cities (+19%)". Sensitivity analyses found the change in consumption of SSBs and soda in Berkeley compared to those of comparison cities remained significant. However, changes related to sports drinks did not retain significance. Additionally, "of the 124 (22%) who reported changing drinking habits because of the tax, 101 (82%) reported drinking SSBs less frequently and 48 (40%) reported drinking smaller sizes because of the tax." Authors report "the 21% reduction in SSB consumption that we saw in low-income Berkeley neighborhoods represents a price elasticity of  $-2.6$ , and the relative reduction we saw of 25% (relative to comparison neighborhoods) would represent a price elasticity of  $-3.1$ ", which is higher than other studies have reported (e.g., Powell et al.  $-1.2$  price elasticity for SSBs). Authors hypothesized the higher price elasticity could be San Francisco Bay Area specific, related to lower-income populations, reflect early reactions to the tax, be attributable to an overall health consciousness in Berkeley, or changes in attitudes due to the "Berkeley vs. Big Soda" pro-tax campaign. Study results indicate that only 2% of Berkeley residents who reported having bought SSBs primarily in Berkeley before the tax reported cross-border shopping following implementation of the tax.

30. **Cabrera Escobar M.A., Verrman J.L. , Tollman S.M., et al. Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. *BMC Public Health*. 2013;13:1072.**

Cabrera Escobar et al. conducted a meta-analysis using articles published between January 2000 and January 2013 to evaluate the literature on SSB taxes or price increases, and their potential impact on consumption levels, obesity, overweight and body mass index (BMI). Authors identified 9 articles that met inclusion criteria (6 from the USA and 1 each from Mexico, Brazil, and France). The meta-analysis found pooled own price-elasticity was -1.299 (95% CI: -1.089 to -1.509). Six articles from the USA provided evidence that "a higher price could also lead to a decrease in BMI, and decrease in the prevalence of overweight and obesity." Authors stated, "This comprehensive literature review suggests that an increase in price of SSBs is associated with a decrease in consumption; and the higher the price increase, the greater the reduction in consumption." They also discussed the opposition argument that implementing an excise tax alone is a regressive approach. They noted that "lower-income households tend to spend a greater portion of their income on consumable goods than higher-income households" and that "relative to income, a SSB tax would therefore affect low-income people more than high-income people." However, authors also shared that specifically because low income households are more price sensitive, as a group they will also likely to benefit more from the policy. "To the extent that low-income individuals are more price sensitive, they will be more likely to cut back on the intake of taxed SSBs, often from a higher consumption level and with a higher BMI, and thus experience greater health gain." The cited evidence that "low income earners are now a population with high consumption of unhealthy obesogenic food." They recommend future research study and "address the consequences of a tax on SSBs, including the health gains, population affected and the impact on the macroeconomic environment including jobs, monetary savings to the health sector, implementation costs and revenue generated for the government."

31. **Yin J., Zhu Y., Malik V., et al. Intake of Sugar-Sweetened and Low-Calorie Sweetened Beverages and Risk of Cardiovascular Disease: A Meta-Analysis and Systematic Review. *Adv Nutr*. 2021;12(1):89-101.**

Yin et. al. conducted a systematic review of literature published through 2019 and a meta-analysis examining the association between consuming SSBs and cardiovascular disease and mortality. The meta-analysis included 11 articles evaluating the impacts of consuming SSBs and 8 articles evaluating the impacts of consuming low-calorie sweetened beverages. Overall, they found that an additional one serving/day (250 mL/day) of SSBs was associated with an 9% increase of cardiovascular disease and an 8% increase of cardiovascular disease-related mortality. The authors explained, "under an assumption of causality, the consumption of SSBs may be linked to 9.3%...of predicted [cardiovascular disease] incidence in the [U.S.] from 2015 to 2025, among men and nonpregnant women, who were aged 40-79 [years] in 2015-2016." The authors also found that, "each serving/day increment of SSBs was associated with a marginally higher risk of stroke...in our pooled results." The study authors also pointed out that there is still limited evidence about the health impacts of low-calorie sweetened beverages (i.e. beverages sweetened with alternatives including aspartame, sucralose, etc). They summarized previous research indicating that, "consistent findings from well-designed cohort studies and high-quality trials provide strong evidence for a potential role of SSBs in the etiology of cardiometabolic diseases."



32. **Qin P., Li Q., Zhao Y., et al. Sugar and artificially sweetened beverages and risk of obesity, type 2 diabetes mellitus, hypertension, and all-cause mortality: a dose-response meta-analysis of prospective cohort studies. *European Journal of Epidemiology*. 2020;35(7):655-671.**

Qin et al. conducted a systematic review of literature published through 2019 and a meta-analysis to determine the dose-response relationship between consumption of SSBs and the risk of obesity, Type 2 diabetes, hypertension, and mortality. A total of 39 articles were included in the meta-analysis that examined the association between sugar sweetened-beverages and health outcomes, including 7 for obesity, 19 for Type-2 diabetes, 7 for hypertension, and 10 for all-cause mortality. All used prospective cohort studies. Overall, consumption of SSBs was associated with increased risk of obesity, Type 2 diabetes, hypertension, and all-cause mortality. The authors calculated that, for every 250 mL/day (1 additional serving per day) increase in the consumption of SSBs, risk increased by 12% for obesity, 15% for Type 2 diabetes, 10% for hypertension, and 4% for all-cause mortality. While artificially-sweetened beverages have been marketed as healthier alternatives, the authors also found that consumption of artificially-sweetened beverages was also associated with increased risk of obesity, Type 2 diabetes, hypertension, and all-cause mortality. For every 250 mL/day (1 additional serving per day) increase in the consumption of artificially-sweetened beverages, risk increased by 21% for obesity, 19% for Type 2 diabetes, 8% for hypertension, and 6% for all-cause mortality. The authors explained how consumption of SSBs impacts health: “First, intake of SSBs can increase blood glucose levels and increase appetite, thereby promoting weight gain. Second, SSBs are the greatest source of fructose-containing sugars in the diet, and the effect...on cardiometabolic diseases are mainly from fructose. High intake of fructose can be metabolized to lipids in the liver and promote the synthesis of triglycerides...which may lead to increased insulin resistance and further diabetes and cardiovascular disease. Third, SSBs have been suggested to result in increased serum uric acid concentrations, insulin resistance and obesity...[which] may also explain why SSBs consumption can increase the risk of incident hypertension. Moreover, people with high consumption...may be more physically inactive, consume more unhealthy foods and snacks and have low-quality diets, which are linked to increase risk of obesity, [Type 2 diabetes], hypertension, and all-cause mortality.”

33. **Asgari-Taee F., Zerafati-Shoae N., Dehghani M., et al. Association of sugar sweetened beverages consumption with non-alcoholic fatty liver disease: a systematic review and meta-analysis. *Eur J Nutr*. 2019;58(5):1759-1769.**

Asgari-Taee et al. conducted a systematic review of literature published through 2016 and a meta-analysis of the impacts of SSB consumption on non-alcoholic fatty liver disease (NAFLD). The meta-analysis included data from 4 studies. NAFLD “is now the most frequent cause of chronic liver dysfunction” and embodies a wide-spectrum of liver diseases. Overall, the study found that consumption of SSBs increased the odds of NAFLD by 40%, indicating that consumption of SSBs may be a considerable predictor of fatty liver disease.

34. **Farhangi M. A., Nikniaz L., Khodarahmi M. Sugar-sweetened beverages increases the risk of hypertension among children and adolescence: a systematic review and dose-response meta-analysis. *J Transl Med*. 2020;18(1):344.**

Farhangi et. al. conducted a systematic review of the literature published through March 2020 and a meta-analysis evaluating the association of SSB consumption and hypertension in children

and youth younger than 19 years old. Fourteen studies were included in the meta-analysis. Their analysis found that “high [sugar sweetened beverage] consumption was associated with 1.67 mmHg increase in [systolic blood pressure] in children and adolescents.” Children and youth that consumed high levels of SSBs were 1.36 times more likely to develop hypertension than low consumers. The authors explain that: “Increased sympathetic nervous system activity, significant increase in blood pressure due to...fructose affecting salt metabolism, and increased serum uric acid due to fructose metabolism are several suggested mechanisms of the association between SSBs intake and hypertension among children and adults.” Overall, the study concluded that high SSB consumption was associated with higher systolic blood pressure and increased odds of hypertension in children and youth younger than 19 years of age.

**35. Valenzuela M. J., Waterhouse B., Aggarwal V. R., et al. Effect of sugar-sweetened beverages on oral health: a systematic review and meta-analysis. *European Journal of Public Health*. 2021;31(1):122-129.**

Valenzuela et. al. conducted a systematic review of the literature published through October 2017 and a meta-analysis evaluating the association of SSB consumption and oral health outcomes, including dental caries and erosion. The meta-analysis included data from 24 studies evaluating caries and 15 studies evaluating erosion, including studies with children, youth, and adults. Overall, consumption of SSBs significantly increased the risk of dental caries and erosion. Sweetened beverages “are highly acidic, and contribute to the development of dental caries and tooth erosion.” Additionally, “those consuming SSBs daily or several times-a-week have greater odds of having dental caries and erosion than people who consume [sugar sweetened beverages] less than twice-a-week”, demonstrating a dose-response relationship.

**36. Management Office of Financial. Multiple Agency Fiscal Note Summary: SB 5371 (Sweetened beverage tax).2021.**

The Fiscal Note for SB 5371 (Sweetened beverage tax) includes estimates of fiscal impacts from the Office of the Governor, Office of State Treasurer, and Department of Revenue. The Office of the Governor reported no fiscal impact. The Office of State Treasurer reported indeterminate cost and/or savings as “cash flows are currently unavailable; therefore, estimated earnings from investments are indeterminable.” The Department of Revenue assumes that the bill would impact 8,300 taxpayers (i.e., businesses distributing sweetened beverages). For Fiscal Year (FY) 2023 (the first full year after implementation), the Department of Revenue projects that a tax on sweetened beverages would likely generate \$220.9 million. For FY 2023, the department predicts revenue from the tax will deposit about \$90.5 million into the Foundational Public Health Services account and \$135.7 million into the new health equity account created by provisions in SB 5371. Estimates project that the revenue from the tax will increase over the next 10 years, with a tax revenue of \$335.3 million in FY 2031. From FY 2022 through FY 2031, the Department of Revenue projects that the tax revenue from sweetened beverages will be approximately \$2.6 billion. Lastly, Department of Revenue projects that the change in the consumer price index will be 1.81% for all urban consumers in the Seattle area for FY 2023.

**37. Information for tribal members/citizens. 2021; Available at: <https://dor.wa.gov/get-form-or-publication/publications-subject/tax-topics/information-tribal-memberscitizens>. Accessed 2/25/2021.**

The Washington State Department of Revenue provides information about taxes for tribal members/citizens. They state that, “tribal members/citizens do not pay state taxes for their transactions that occur in their Indian Country.”

**38. Rosinger A., Herrick K., Gahche J., et al. Sugar-sweetened beverage consumption among U.S. adults, 2011-2014. National Center for Health Statistics Data Brief. Centers for Disease Control and Prevention; 2017.**

The 2011-2014 National Health and Nutrition Examination Survey (NHANES) provided the most current national information available about consumption of SSBs among the U.S. adult population. The survey shows that approximately 50% of U.S. adults consume at least one SSB on a given day. SSBs accounted for approximately 6.5% of daily caloric intake for U.S. adults. This report from the National Center for Health Statistics presents data by sex, age, and race/ethnicity. Data show that SSBs contributed to the highest proportion of total daily calories for individuals identifying as non-Hispanic Black (8.3% of total daily calories for non-Hispanic Black men; 8.9% for non-Hispanic Black women) and Hispanics (8.1% of total daily calories for Hispanic men; 7.4% for Hispanic women) compared to 6.4% of total daily calories for white men and 5.4% for white women. Asian adults had the lowest percentages of total daily calories from SSBs.

**39. Rosinger A., Herrick K., Gahche J., et al. Sugar-sweetened beverage consumption among U.S. youth, 2011-2014. National Center for Health Statistics Data Brief. Centers for Disease Control and Prevention; 2017.**

The 2011-2014 National Health and Nutrition Examination Survey (NHANES) provided the most current national information available about consumption of SSBs among U.S. youth aged 2 to 19 years. The survey shows that approximately 63% of youth consume at least one SSB on a given day. Sugar sweetened beverages accounted for approximately 7.3% of daily caloric intake for U.S. youth. This report from the National Center for Health Statistics presents data by sex, age, and race/ethnicity. While the percentage of total daily calories from SSBs was similar for Black, white, and Hispanic boys (approximately 7%), Black girls consumed a significantly higher percentage of total daily calories from SSBs than Hispanic girls or Black boys (8.9% compared to 6.8% and 7.9% respectively). Asian youth had the lowest percentages of total daily calories from SSBs.

**40. Behavioral Risk Factor Surveillance System: Washington State. 2019.**

In 2019, the Behavioral Risk Factor Surveillance System (BRFSS) survey asked about SSB consumption in Washington State. Approximately 72.5% of individuals reported drinking SSBs in the past 30 days, with an average consumption rate of 21.4 drinks per month. Generally, SSB consumption was generally higher among individuals with lower incomes compared to individuals with annual incomes over \$100 thousand. For example, 79% of individuals with annual incomes between \$10-\$15 thousand reported drinking SSBs in the past 30 days compared to 67% of individuals with annual incomes above \$100 thousand. Individuals with annual incomes above \$100 thousand also reported the lowest average consumption rate (15.1 drinks in the past 30 days). Individuals with incomes below \$50 thousand also reported consuming more than the statewide average number of SSBs per 30 day month (21.4 drinks), while individuals with incomes above \$50 thousand reported consuming less than the statewide average. Individuals of color reported the highest consumption of SSBs. Individuals who identified as

American Indian or Alaska Native had the highest prevalence of SSB consumption (81%) and the highest average consumption rate (36.1 drinks in the past 30 days). Individuals who identified as Hispanic, Asian, Black, and multiracial also all reported higher prevalence of SSB consumption than white individuals. Individuals who identified as Asian reported the lowest average consumption rate (16.5 drinks in the past 30 days).

41. **Gortmaker SL, Long MW, Ward ZJ, et al. Sugar-Sweetened Beverage Tax, Seattle, WA. CHOICES Project at the Harvard T.H. Chan School of Public Health;2018.**

The CHOICES Project at the Harvard T.H. Chan School of Public Health modeled the potential impacts of Seattle's proposed 1.75 cent SSB tax from 2015 to 2025. They estimated that price would increase 21.5% and consumption would decrease by 21% among communities with low-incomes. Based on their modeling information, they found that, "on average, each 8.5 oz serving of SSBs per day increases the risk of diabetes by 18%. In Seattle, WA, we estimated that the proposed SSB excise tax would lead to a 5% reduction in diabetes incidence- an estimated 130 cases of diabetes prevented- over a one-year period once the tax reaches its full effect." Their model assumes a reduction in consumption. The project also found that individuals with low-incomes as well as some communities of color consume, on average, more SSBs and would experience greater health benefits. Therefore, "disparities in obesity outcomes should thus decrease following the implementation of the proposed tax."

42. **Moreland J, Kraus (McCormick) E, Long MW, et al. Denver: Sugary Drink Excise Tax. CHOICES Project at the Harvard T.H. Chan School of Public Health;2019.**

The CHOICES Project at the Harvard T.H. Chan School of Public Health modeled the potential impacts of a SSB tax in Denver, Colorado. They estimated the "impact of the tax-induced reduction in sugary drink intake on diabetes incidence for adults ages 18-79." Their model suggested that a SSB tax in Denver would reduce diabetes incidence by 7%. Their model assumes an increase in price to consumers and a reduction in consumption. This briefing also provides discussion of potential impacts on health equity.

43. **Backholer K. , Sarink D. , Beauchamp A., et al. The impact of a tax on sugar-sweetened beverages according to socio-economic position: a systematic review of the evidence. *Public Health Nutrition*. 2016;19(17):3070-3084.**

Backholer et al. conducted a systematic review of literature published before June 2015 for studies (of any study design) conducted in high-income countries that examined the effect of an SSB price increase on beverage purchase or consumption and/or weight outcomes according to an indicator of SEP. Their aim was to clarify the differential impact(s) of SSB taxes on beverage purchases and consumption, weight outcomes and the amount paid in SSB taxes according to socio-economic position (SEP). "Of the [11] included articles [7 from USA, 1 from each of the UK, Ireland, Australia, and New Zealand], three study types were identified: (i) those that examined the association between variation in SSB taxes and SSB consumption and/or body weight (n 3); (ii) price elasticity estimation of SSB demand (n 1); and (iii) modelling of hypothetical SSB taxes by combining price elasticity estimates with population SEP-specific beverage consumption, energy intake or body weight (n 7)." Authors noted few studies statistically tested differences in outcomes between SEP groups. Of the 7 studies assessing changes in weight outcomes for the total population following an increase in SSB price, "all reported either similar reductions in weight across SEP groups or greater reductions for lower

compared with higher SEP groups." Five studies assessed the amount paid in taxes following an increase in the price of SSB by SEP. In order to compare across studies, authors presented differences paid by households with the highest- and lowest-income annually and in \$US using 2015 conversion rates. All five studies "reported that an SSB tax would be regressive, but with small differences between higher- and lower-income households (0.10–1.0% and 0.03%–0.60% of annual household income paid in SSB tax for low- and high-income households, respectively)." Authors concluded, "a tax on SSB will deliver similar population weight benefits across socio-economic strata or greater benefits for lower SEP groups. An SSB tax is shown to be consistently financially regressive, but to a small degree."

44. **Quality Agency for Healthcare Research and. 2016 National Healthcare Quality and Disparities Report.**Rockville, MD: U.S. Department of Health and Human Services;2017. The National Healthcare Quality and Disparities Report is mandated by Congress and has been published every year since 2003. The intent of the report is to summarize the quality of healthcare received by people in the United States, and to identify disparities in care and access to care by priority populations. It evaluates quality of healthcare in six core areas: person-centered care, patient safety, healthy living, effective treatment, care coordination, and care affordability. The report uses four main measures for access to care: having health insurance, having a usual source of care, encountering difficulties when seeking care, and receiving care as soon as wanted. Over time, the report has found disparities in access to care based on race and ethnicity, socioeconomic status, age, sex, disability status, sexual orientation, gender identity, and residential location. The 2016 report concluded that, while disparities in health insurance status decreased since 2014, about 70% of care affordability measures have not changed since 2010 and disparities in care persisted for poor and uninsured populations in all priority areas. The report stated, "poor people experienced worse access to care compared with high income people for all access measures except one" and "more than half of measures show that poor and low-income households have worse care than high-income households." Further, the report concluded that "significant disparities continue for poor people compared with high-income people who report they were unable to get or were delayed in getting needed medical care due to financial or insurance reasons."

45. **Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Prevalence And Trends Data: Washington-2014. 2014; Available at: <http://apps.nccd.cdc.gov/brfss/page.asp?cat=XX&yr=2014&state=WA#XX>. Accessed August 16, 2016.**

Behavioral Risk Factor Surveillance System (BRFSS) 2014 data from Washington state show significant correlations between lower income and a number of health indicators including: worse overall self-reported health, depression, asthma, arthritis, stroke, oral health, tobacco use, women's health indicators, health screening rates, physical activity, and diabetes.

46. **Poel A. Health of Washington State Report: Mortality and Life Expectancy. Data Update 2015. Washington State Department of Health;2015.**

Poel presents Washington state data on mortality and life expectancy. The data show that age-adjusted death rates were higher in Washington census tracts with higher poverty rates. The state data also show that American Indian/Alaska Natives, Native Hawaiian/Other Pacific Islanders, and black residents had the highest age-adjusted death rate and shortest life expectancy at birth

compared to other groups in the state. Children 1-4 and 5-14 experience the lowest mortality rates, with no difference between sexes. However, in each of the remaining age groups, death rates among men are higher than death rates for women, including among those aged 85 or older.

**47. Serafin M. Health of Washington State Report: Self-reported Health Status. Data Update 2016. Washington State Department of Health;2016.**

Serafin presents data from Washington state on self-reported health status. The data show that after accounting for age, education, race and ethnicity, household income was a strong predictor of self-reported health status. Health status varied by race and ethnicity, with close to 20% of Native Hawaiian/Other Pacific Islander reporting fair or poor health.

**48. Spencer N., Thanh T. M., Louise S. Low income/socio-economic status in early childhood and physical health in later childhood/adolescence: a systematic review. *Maternal and child health journal*. 2013;17(3):424-431.**

Spencer et al. conducted a meta-analysis of studies examining the relationship between low socioeconomic status in the first five years of life and physical health outcomes in later childhood and adolescence. Nine studies met the researchers' strict inclusion criteria. The studies indicated significant associations between early childhood low-income status and a number of adverse health outcomes including: activity-limiting illness, parent-reported poor health status, acute and recurrent infections, increasing body mass index (BMI), dental caries, and higher rates of hospitalization.

**49. Rosinger A., Herrick K., Gahche J., et al. Sugar-sweetened beverage consumption among U.S. adults, 2011-2014. *National Center for Health Statistics Data Brief (Centers for Disease Control and Prevention)*. 2017(270).**

The 2011-2014 National Health and Nutrition Examination Survey (NHANES) provided the most current national information available about consumption of SSBs among U.S. youth aged 2 to 19 years. The survey shows that approximately 63% of youth consume at least one SSB on a given day. Sugar sweetened beverages accounted for approximately 7.3% of daily caloric intake for U.S. youth. This report from the National Center for Health Statistics presents data by sex, age, and race/ethnicity. While the percentage of total daily calories from SSBs was similar for Black, white, and Hispanic boys (approximately 7%), Black girls consumed a significantly higher percentage of total daily calories from SSBs than Hispanic girls or Black boys (8.9% compared to 6.8% and 7.9% respectively). Asian youth had the lowest percentages of total daily calories from SSBs.

**50. The Henderson Center for Social Justice Berkeley Law. Equal opportunity: The Evidence- a summary of key ideas , current research, and relevant information for those who aim to promote and protect equal opportunity. University of California Berkeley;2012.**

University of California Berkeley's Henderson Center for Social Justice provided an overview and history of equal opportunity efforts in the U.S. They use the term "equal opportunity" to include both affirmative action and equal opportunity efforts. Affirmative action and equal opportunity programs began as a result of the Kennedy Administration's Executive Order 10925, which required government contractors to "take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin." This report summarizes information related to contracting,

education, wealth, homeownership, and other factors. It stated that "overall, people of color rate their health status lower than Whites ([non-Hispanic]). The life expectancy at birth for African Americans is five years less than for Whites...In general, people of color report less access to health care and poorer quality health care than Whites ([non-Hispanic])." The report found that, "although the effect of [state affirmative action] bans are complicated to assess, there is a recurring pattern of decreased diversity." The report presents some research on Washington State. For contracting, transportation contracts awarded to minority-owned and women-owned businesses increased under affirmative action and decreased sharply after I-200 passed in 1998. Similarly, applications and enrollment by people of color decreased at University of Washington, and to a lesser degree at other public universities. For public employment, the authors note that, "in Washington, the diversity of state employees before and after the passage of the anti-equal opportunity Initiative 200 in 1998 has not been tracked." They noted that Washington State began tracking this information in 2006, and that the current state workforce is similar in diversity to the private sector, though people of color were slightly less represented.

**51. Kemple Angela. Health of Washington State Report: Coronary Heart Disease. Tumwater, Washington: Washington State Department of Health; 17 February 2016 2016.**

Kemple presents data from Washington regarding coronary heart disease in the state. Washington data from the Behavioral Risk Factor Surveillance System (BRFSS) from 2012-2014 combined, age-adjusted coronary heart disease death rates were 1.7 times higher for Washington residents in census tracts where less than 15% of the population were college graduates compared to rates in census tracts where 45% or more of the population were college graduates. Further, BRFSS data also show that age-adjusted diabetes prevalence is highest among Native Hawaiians and Other Pacific Islanders, American Indian/Alaska Native, and Blacks. The numbers and rates of coronary heart disease deaths in Washington increase with age. In each age group, men have higher rates than women

**52. Health Washington State Department of. 2018 Washington State Health Assessment. March 2018 2018.**

The *State Health Assessment* provides an overview of health and well-being of Washington residents. It outlines the changing population trends --increasing in number, becoming more racially and ethnically diverse, and aging. It also discusses disparate health outcomes experienced by various populations within Washington.

**53. Prather Cynthia, Fuller Taleria R., Marshall Khiya J., et al. The Impact of Racism on the Sexual and Reproductive Health of African American Women. *Journal of Womens Health (Larchmt)*. 2016;25(7):664-671.**

Prather et al. use the socioecological model to describe racism and its effect on African American women's sexual and reproductive health. Authors examine the historical context of racism (e.g., medical experimentation) as well as institutional racism (society), personally mediated racism (neighborhood/community), and internalized racism (family/interpersonal supports and individual). Authors concluded, "[i]n both historical and contemporary contexts, race-based mistreatment has been shown to place African American women at increased risk for HIV/STIs, pregnancy-related complications, and early mortality."

54. **Eichelberger Kacey Y., Doll Kemi, Ekpo Geraldine E., et al. Black Lives Matter: Claiming a Space for Evidence-Based Outrage in Obstetrics and Gynecology. *American Journal of Public Health*. 2016;106(10):1771-1772.**

This AJPH perspective provides an overview of why authors believe the phrase "Black Lives Matter" should inform obstetric and gynecological care.

55. **Kemple Angela. Health of Washington State Report: Stroke. Tumwater, Washington: Washington State Department of Health;2016.**

Kemple presents data from Washington regarding stroke in the state. Washington data from the Behavioral Risk Factor Surveillance System (BRFSS) from 2012-2014 show that among adults, the percentage of persons with stroke increased as household income decreased. This relationship was also true for education. Further, BRFSS data also show that age-adjusted diabetes prevalence is highest among those who are black and American Indian/Alaska Native. The rate for Native Hawaiian and other Pacific Islander residents is also high (81 deaths per 100,000 people), but subject to greater random variation than rates for other groups because of small numbers. Men ages 45–74 have higher stroke death rates than women, and women ages 85 and older have higher stroke death rates than men.

56. **Health of Washington State: Mental Health. Washington State Department of Health;2008.**

Washington Behavioral Risk Factor Surveillance System (BRFSS) data from 2004-2006 indicate that American Indians/Alaska Natives and non-Hispanic Black individuals reported significantly higher rates of poor mental health compared to other groups. These relationships persisted after adjusting for additional factors such as age, income, and education. Washington BRFSS data also show an association between lower annual household income and poor mental health, a relationship that was also shown with education. It is well understood that mental health is also closely related to other areas such as employment opportunities, physical health, and substance abuse. This report also highlights a Washington State study from 2002 that reveal that 16% of individuals in the state who were receiving publicly funded mental health services had at least one felony conviction, a rate over twice that of the general population.

57. **Christensen Trevor, Weisser Justin. Health of Washington State Report: Tobacco Use. Washington State Department of Health;2015.**

Christensen et al. report Washington state Behavioral Risk Factor Surveillance System (BRFSS) data from 2012 to 2014 indicate that prevalence of smoking decreases as income and levels of education increase. Further, American Indians and Alaska Natives (AI/AN) and Native Hawaiian/Other Pacific Islander populations have significantly higher smoking rates than white, black, Hispanic, and Asian populations.

58. **Kemple Angela. Health of Washington State Report: Diabetes. Washington State Department of Health;2016.**

Kemple presents data from Washington regarding diabetes in the state. Washington data from the Behavioral Risk Factor Surveillance System (BRFSS) from 2012-2014 show that among adults, the percentage of persons with diabetes increased as household income decreased. This relationship was also true for education. Further, BRFSS data also show that age-adjusted



diabetes prevalence is highest among those who are Hispanic, American Indian/Alaska Native, and black.

**59. VanEenwyk J. Health of Washington State Report: Socioeconomic Position in Washington. Washington State Department of Health;2016.**

VanEenwyk presents data about socioeconomic position in Washington State including differences within the state as well as statewide differences compared to national data. Data indicate that compared to the United States as a whole, fewer Washington residents are living in poverty and a higher percentage of residents ages 25 and older have college degrees. However, these economic resources are not evenly distributed among all Washington residents. Females in Washington were more likely to be living in poverty than males and were also more likely to have lower wages. Further, American Indian and Alaska Native, Hispanic, and black residents had higher percentages of living in poverty and lower median household incomes compared to other groups. Data also indicated that counties in eastern Washington were more likely to have high poverty rates and high rates of unemployment than counties in western Washington.

**60. Ellings Amy. Health of Washington State Report: Obesity and Overweight. Washington State Department of Health;2015.**

Ellings reports Washington state Behavioral Risk Factor Surveillance System (BRFSS) data from 2002-2014, which shows that obesity rates are the highest among low income families and that as income increases, rates of obesity decrease. Further, individuals that graduated college or attended some college had lower rates of obesity than those who had a high school education or less. Black, American Indian and Alaska Native, and Hispanic Washington residents had higher rates of obesity even after accounting for gender, income, education, and age.

**61. Health of Washington State Report: Mental Health. Tumwater, Washington: Washington State Department of Health;2007.**

This document presents data from Washington regarding poor mental health in the state. Washington data from the Behavioral Risk Factor Surveillance System (BRFSS) 2004-2006 show that among adults, the percentage of adults who report 14 or more days of poor mental health in the previous month increased as household income decreased. The relationship of mental health and education is similar to that of mental health and income. American Indians and Alaska Natives reported significantly higher rates of poor mental health (19% ±4%) than other racial and ethnic groups.

**62. Marinello S., Leider J., Pugach O., et al. The impact of the Philadelphia beverage tax on employment: A synthetic control analysis. *Economics and Human Biology*. 2021;40:1-9.**

Marinello et. al. evaluated the impact of Philadelphia's SSB tax on employment. They analyzed data from the Bureau of Labor Statistics from January 2012 through June 2019, spanning before and after the tax was implemented in 2017, across a range of business types (e.g. restaurants, convenience stores). They also compared changes in employment with control jurisdictions. They "did not find that the sweetened beverage tax resulted in job losses up to two and a half years after the tax was implemented." They explained that there were two reasons impacts on employment were not observed, "consumers who reduce purchases of sweetened beverages will spend more on other goods and services and governments will spend new revenue generated

from the tax. While there may have been job losses in some industries as a result of the tax, the finding that total and private sector employment did not change suggests that any potential losses were offset by gains in other industries and sectors.” Overall, “we find no evidence that the tax resulted in job losses in the overall economy, private sector, limited-service restaurants, or convenience stores.” The authors noted that this is one of the only studies and the first in the U.S. to empirically evaluate unintended economic impacts of an excise tax on SSBs. The authors noted that the study has a number of limitations, and could not evaluate impacts to beverage manufacturers or grocery stores; to hours worked or wages; or to types of jobs available (e.g. were higher paying jobs replaced by lower-paying jobs), which could have been impacted by the tax. They also noted that, “only non-peer-reviewed studies, several of which were funded by the soft drink industry, estimated job losses using projection economic modeling.”

**63. Krieger J., Magee K., Hennings T., et al. How sugar-sweetened beverage tax revenues are being used in the United States (manuscript draft). 2020.**

This research, pending publication in Preventive Medicine Reports, by Krieger et al. is the first analysis of how revenue from SSB taxes in 7 U.S. jurisdictions has been invested. Overall, authors found that “over 90% of SSB tax-revenue investments directly support community health and develop human and community capital, and that the majority of funds are being invested in marginalized communities, which bear a disproportionate burden from diseases associated with sugary drinks.” Moreover, “these investments may yield additional health benefits beyond those resulting from lower SSB consumption” and may further advance equity. Based on data collected from the 7 U.S. jurisdictions with a SSB, the authors determined that revenues total \$133.9 million annually and that revenues appear stable over time. Total revenues varied by location, differences in tax rates, sales volumes, and population size. Across all 7 jurisdictions, 66% of revenue was invested in human and community capital (e.g. early childhood development; community infrastructure; workforce development; youth development); 27% was invested in health-related goals (e.g. access to healthy foods and beverages; physical activity opportunities; physical, mental, or social health and well-being programs; health and nutrition knowledge; chronic disease prevention and management; reduction of SSB consumption); and 7% of revenue was used for administration costs (e.g. tax administration, evaluation). Across all 7 jurisdictions, approximately \$1.7 million was “allocated specifically towards reducing SSB consumption- a primary purpose of SSB taxes- through nutrition education in schools, training community members to advocate for SSB reduction, and promoting policies to reduce SSBs. An additional \$3.7 [million] supported activities included in other goal categories that incorporated SSB reduction activities.” In Seattle, which specified the intent of how revenue was invested, 88% of revenue was used as intended. Lastly, “allocations reflected interest in racial, social, and health equity, with 83% of funds directed toward benefitting populations affected by inequities.”