

# 24 Month Report: Child Cohort Examining Beverage Consumption

THE EVALUATION OF SEATTLE'S SWEETENED BEVERAGE TAX

MARCH 2023

Saelens BE, Rowland MG, Kidane S, Qu P, Jones-Smith JC, Chan NL

Public Health  
Seattle & King County



Seattle Children's<sup>®</sup>  
HOSPITAL · RESEARCH · FOUNDATION

Research Institute

## **SUGGESTED CITATION**

Saelens BE, Rowland MG, Kidane S, Qu P, Jones-Smith JC, Chan NL. 24 Month Report: Child Cohort Examining Beverage Consumption - The Evaluation of Seattle's Sweetened Beverage Tax. Report for City of Seattle and Seattle City Council. March 2023.

## **CONTACT INFORMATION**

Brian E. Saelens, PhD

[brian.saelens@seattlechildrens.org](mailto:brian.saelens@seattlechildrens.org)

206-884-8247

## **FUNDING SOURCE**

This report is funded by City of Seattle Sweetened Beverage Tax Ordinance 125324.

**CONTENTS**

SUMMARY ..... 4

OBJECTIVE ..... 5

METHODS..... 5

RESULTS ..... 7

CONCLUSION..... 18

STRENGTHS AND LIMITATIONS ..... 20

REFERENCES ..... 22

APPENDIX: CHILD COHORT 24-MONTH DESIGN, SAMPLE, AND METHODS ..... 23

## CHANGE IN CONSUMPTION OF SUGARY BEVERAGES – TWO YEARS LATER

### SUMMARY

We conducted surveys with lower-income children and parents living in Seattle and in a Comparison area that included Renton, Federal Way, Kent, Auburn, and other South King County cities to measure their change in beverage consumption. Children and parents from lower income households completed surveys at four periods: before Seattle’s Sweetened Beverage Tax began in January 2018, and then six, twelve, and 24 months later. Prior reports examined the changes from pre-tax to 6-month and 12-month post-tax periods. The primary objective of this report was to explore whether consumption of sugary beverages that were subject to the tax in Seattle changed from before to 24 months after the tax, among children and parents living in Seattle, compared to children and parents living in the Comparison area where the same beverages were not subject to the Sweetened Beverage Tax. We also explored whether there were different child and parental changes in consumption of non-taxed beverages (including water) by location, and parents’ awareness, attitudes, and experiences with the Sweetened Beverage Tax.

### KEY FINDINGS

- At 24 months after the launch of Seattle’s Sweetened Beverage tax, children and parents reported that consumption of sugary beverages subject to the tax was lower than before the tax among both residents in Seattle and the Comparison area
- There was no difference in the change/decrease in overall sugary beverage consumption between Seattle and the Comparison area children or parents from before the tax to either the 12-month or 24-month periods after the tax was implemented in Seattle
- Among individual sugary beverages, Seattle parents reported greater reductions in consumption of prepared/bottled tea or coffee with sugar from before to 24 months after the tax compared to Comparison area parents
- There was no differential change in consumption of non-taxed beverages between Seattle and Comparison area children or parents from before the tax to either the 12-month or 24-month periods after the tax was implemented in Seattle
- Most parents were aware of the Seattle Sweetened Beverage Tax, although such awareness was slightly higher among Seattle parents, with most parents having neutral attitudes (neither accepting/supportive or opposed) about the tax
- Among parents reporting a reduction in sugary beverage consumption in the past two years, Seattle parents were more likely than Comparison area parents to report the tax or costs of these beverages as the primary reason for reducing consumption
- Community event conversations suggested that parents and children were not surprised by the findings of decreased sugary beverage consumption for both Seattle and Comparison area families because of the 1) growing awareness of health effects, 2) the high costs of sugary beverages even in non-taxed areas, 3) perceived differences in financial supports for lower-income families between Seattle and the Comparison area, and 4) because their participation in this study/evaluation made them more aware of their beverage consumption
- Community event conversations indicated some awareness of anger or frustration about the tax particularly when it was first implemented, but some parents were supportive of the tax and the benefits it provided, while others were unsure where the revenue from the tax was going and wanted more transparency about how the tax revenue was being used.

## OBJECTIVE

Our primary objective was to examine whether children from lower-income families (<312% Federal Poverty Level) living in Seattle reduced their consumption of sugary beverages from before Seattle's Sweetened Beverage Tax (SBT) went into effect to the same time of year 24 months after the tax went into effect. To test whether these changes were due to the tax itself or other things, we also examined changes in beverage consumption among children from lower-income families living in a nearby Comparison area (South King County outside of Seattle) with no sugary beverage tax. We surveyed the same families before the tax, then six, twelve, and 24 months later, instead of surveying different families at these time-points, so that other individual characteristics that may affect beverage consumption would remain constant across time-points. We found no significant difference in the change in either child or parent sugary beverage consumption from before to 12 months after the tax was implemented between those living in Seattle versus the Comparison area. Consumption of taxed sugary beverages decreased in both Seattle and Comparison area children and parents from before to 12 months after the tax. The objective of the 24-month data collection was to examine whether these findings were sustained at this longer-term timepoint.

In addition, we were interested in understanding how the tax was perceived by the child cohort participants. Little is known about people's perceptions of sugary beverage taxes (SBT), particularly their awareness and acceptance of it after tax implementation, or what factors are related to awareness and acceptance. Prior to 24-month data collection, we did not indicate to participants that the study was specifically about the SBT as we did not want this to influence their beverage consumption reporting. However, in 24-month data collection, we gathered information on whether parents and children believed they had changed their sugary beverage consumption in the last year and if the tax was a reason for that change. We also asked about their experiences with and recollections about the SBT.

## METHODS

We recruited and collected survey data from lower-income children and parents before the tax was implemented, and then six, twelve, and 24 months later. At 24-month follow up we received survey responses back from a total of 303 families - 143 families based in Seattle at baseline and 187 families based in the Comparison area at baseline. Our retention rate at 24-month follow-up was 72% among eligible families, although removing outliers and those with incomplete data reduced the sample in the final 24-month analysis to 324 for parent data and 320 for child data among the full sample of participants (approximately 70% retention), regardless of whether they moved during the study period.

More details about initial recruitment of families, prior to the tax being implemented, are provided in the baseline (before the tax) report which is available at: (<https://www.seattle.gov/Documents/Departments/CityAuditor/auditreports/SBTBaselineReport.pdf>). This baseline report also provides details about the survey methods and the baseline sample. Details about the participant engagement, demographic characteristics of the sample (**Appendix Table 1**), methods for the 24-month data collection, and data analysis are provided in the Appendix to this present report.

### *Beverage consumption*

Beverage consumption was based on parent or teen report. As in prior timepoints, parents reported on their own beverage consumption and reported on younger children's (<11 years old) beverage consumption. Children 12 years old and older reported on their own beverage consumption. Parent and child surveys included a measure of the frequency and typical volume consumed in the past 30 days of

various beverage types, including beverages taxed and not taxed in Seattle. Additional questions collected were information about children's consumption of foods that are frequent contributors to added sugar in their diets. A questionnaire was added at this 24-month time point to assess general social desirability that sought to measure how much respondents had a tendency to present in a more socially desirable way. This measure was not specific to beverage consumption, the SBT, or any other specific issue. For example, one of the items on the measure is "I am always willing to admit when I make a mistake". Responding affirmatively to this item suggests an interest in presenting in a socially desirable way, even though it is not likely that most or many people always admit fault for every one of their mistakes. For the 24-month time point, we also created a survey about whether or not parents and children changed their consumption of sugary beverages in response to the tax and about their experiences with the tax.

Difference-in-difference analyses examined change from baseline to the 12-month and 24-month follow-ups between Seattle versus Comparison area residents. Separate analyses examined change in taxed and non-taxed beverage consumption among children and adults. We conducted full sample analyses, defined as those whose tax exposure was based on their baseline location - in Seattle or the Comparison area (i.e., assumed that their exposure status did not change through the follow-ups). We also conducted subgroup analyses which included only those families who sustained the same exposure status (Seattle or the Comparison area) from baseline through the follow-up timepoints based on their address reporting at these timepoints.

Since many perceive sugary beverages may not be healthy, we were interested in whether people's level of bias in reporting of pro-social behaviors might affect their reporting of sugary beverage consumption. So, we included a general measure of social desirability in the 24-month data collection - the adult and child versions of the Marlowe-Crown social desirability scales. We conducted analyses examining change in beverage consumption from baseline through the yearly follow-ups after controlling for the general social desirability of the corresponding respondent. That is, we used parent social desirability scores in analyses of parental beverage consumption and in analyses of younger children's beverage consumption. We used teen social desirability scores in analyses of teen beverage consumption. There were no significant differences in social desirability between Seattle and Comparison area residents, but there were negative correlations between respondent social desirability and children's taxed beverage consumption (those having higher social desirability reporting lower taxed beverage consumption) at each time point – baseline ( $r=-0.12$ ), 12-month ( $r=-0.15$ ), and 24-month follow-up ( $r=-0.13$ ). Similar negative correlations were observed between parent's social desirability and reporting on their own taxed beverage consumption at the 12-month ( $r=-0.11$ ) and 24-month follow-up ( $r=-0.11$ ), although not at baseline ( $r=-0.01$ ). Given these associations, social desirability scores were used as covariates in the difference-in-difference analyses for beverage consumption, so estimates are adjusted for social desirability.

As part of the 24-month follow-up survey, parents and teens answered questions about their perceptions of their own beverage consumption patterns, reasons for consumption change (if present), and their general knowledge/perception of the SBT itself. Participants were asked if they had changed how much sugary beverages they consumed in the past few years. If they reported a change in their consumption, participants were asked if it was an increase or decrease. If a decrease, the primary reason for the decrease was asked (health, sugary beverage tax, cost, taste, convenience, or other). Participants were also asked 3 open-ended questions about their experience (e.g., seeing, hearing) with and any changes made as a result of their experience with the SBT. Responses were qualitatively coded

to evaluate participants' awareness and perceptions of the SBT. There was an interest in understanding both Seattle residents and Comparison area residents' attitudes towards the tax and how the tax possibly impacted their beverage consumption.

Concurrent with data analyses, to be good stewards of data provided to us by our community members, we conducted community meetings with study participants. These meetings were designed to present the study findings and to hear their feedback on and interpretation of the data and findings. Full details about the methods of these community meetings are provided in the Appendix.

## RESULTS

### *Children's beverage consumption patterns among sample defined by baseline location*

Children's sugary beverage consumption before the tax and 12-months and 24-months later is provided by location (Seattle or the Comparison area) in **Table 1**. These results are based on the initial (baseline) designation of children's location in the Seattle or the Comparison area and don't account for whether children moved during the follow-up period into or out of these areas. The average change in sugary beverages that would be subject to the tax among children living in Seattle decreased by 1.49 oz/day and 1.26 oz/day respectively from baseline to 12-month and 24-month follow-up. For children living in the Comparison area these corresponding decreases were 2.35 oz/day and 2.17 oz/day. There was not a statistically significant difference-in-difference for change in children's consumption of total taxed beverages between children living in Seattle versus the Comparison area from baseline to either follow-up. There was also no significant difference in change in beverage consumption by location between the 12-month and 24-month follow-up. Ultimately, average total consumption of sugary beverages subject to the tax was similar (<0.7oz/day difference) at the 24-month follow-up among children living in Seattle and the Comparison area.

The pattern of change or difference-in-difference between Seattle and Comparison area children among the individual taxed beverages (e.g., soda/pop with sugar, sports beverages with sugar) was similar to the pattern of overall taxed beverage consumption, with individual beverages demonstrating no significant differential change between the Seattle and Comparison area children from baseline to the post-tax follow-up periods.

**TABLE 1. CHILD CONSUMPTION OF TAXED SUGARY BEVERAGES IN OUNCES PER DAY BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP BASED ON BASELINE LOCATION (SEATTLE OR COMPARISON AREA) WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=132	12-MONTH n=125	24-MONTH n=129	BEFORE THE TAX n=171	12-MONTH n=159	24-MONTH n=168	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>SUGARY BEVERAGES SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX (TOTAL) IN OUNCES PER DAY</b>	<b>6.84 (9.10)</b>	<b>5.35 (9.22)</b>	<b>5.58 (8.99)</b>	<b>7.10 (9.63)</b>	<b>4.75 (7.03)</b>	<b>4.93 (7.05)</b>	<b>0.92 (-2.21,4.04)</b>	<b>1.00 (-1.45, 3.44)</b>	<b>0.08 (-1.84,2.00)</b>
• SODA/POP WITH SUGAR	2.57 (3.74)	1.62 (2.91)	1.94 (4.26)	2.30 (4.53)	1.84 (3.07)	1.80 (3.35)	-0.48 (-1.83,0.87)	-0.13 (-1.20,0.95)	0.36 (-0.57,1.28)
• FRUIT-FLAVORED BEVERAGES WITH SUGAR	1.90 (4.07)	1.75 (4.17)	1.59 (3.35)	2.36 (4.61)	1.61 (3.37)	1.18 (2.87)	0.61 (-0.50,1.71)	0.91 (-0.24,2.06)	0.30 (-0.52,1.13)
• PREPARED/BOTTLED TEA OR COFFEE WITH SUGAR	0.82 (2.05)	0.44 (1.32)	0.67 (2.87)	0.81 (2.12)	0.29 (1.32)	0.78 (2.57)	0.15 (-0.48,0.78)	-0.11 (-0.61,0.39)	-0.26 (-0.89,0.37)
• SPORTS BEVERAGES WITH SUGAR	1.28 (2.52)	1.20 (2.45)	1.07 (2.56)	1.52 (3.94)	0.88 (1.79)	1.04 (2.28)	0.57 (-0.29,1.43)	0.27 (-0.49,1.02)	-0.30 (-0.88,0.28)
• ENERGY BEVERAGES WITH SUGAR	0.27 (1.29)	0.35 (3.24)	0.31 (1.45)	0.10 (0.82)	0.14 (0.78)	0.13 (0.89)	0.04 (-0.55,0.64)	0.01 (-0.59,0.62)	-0.03 (-0.67,0.57)

*Note. Estimates are mean ounces per day consumed with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison area and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area.*

To explore whether other aspects of children’s beverage consumption changed over this time period, **Table 2** provides results for children’s consumption of beverages not subject to the tax. Among these beverages, children’s consumption of water is presented, including tap, bottled, and other water beverages without added flavors or sweeteners or with no or low calories. There was no significant differential change in children’s consumption of beverages not subject to the tax or specifically for mostly water beverages, although reported consumption appears to have decreased for these beverages over time among children in both Seattle and the Comparison area.



**TABLE 2. CHILD CONSUMPTION OF NON-TAXED BEVERAGES IN OUNCES PER DAY AND SPECIFICALLY WATER BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP BASED ON BASELINE LOCATION (SEATTLE OR COMPARISON AREA) WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=132	12-MONTH n=125	24-MONTH n=129	BEFORE THE TAX n=171	12-MONTH n=159	24-MONTH n=168	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>ALL BEVERAGES NOT SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX IN OUNCES PER DAY</b>	<b>53.06</b> (27.20)	<b>44.06</b> (29.68)	<b>40.96</b> (23.03)	<b>50.92</b> (31.64)	<b>45.99</b> (30.50)	<b>44.58</b> (30.47)	<b>-3.84</b> (-13.07,5.40)	<b>-5.59</b> (-14.69,3.50)	<b>-1.76</b> (-9.38,5.87)
• ALL WATER (TAP, BOTTLED, FLAVORED)	32.17 (20.36)	25.55 (17.98)	24.83 (16.92)	31.64 (25.48)	28.83 (22.74)	28.74 (24.70)	-3.37 (-11.31,4.58)	-4.38 (-10.97,2.22)	-1.01 (-7.19,5.17)

Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area.

*Parent beverage consumption patterns among sample defined by baseline location*

Parent sugary beverage consumption before the tax and 12-months and 24-months later is provided by location (Seattle or the Comparison area as defined at baseline) in **Table 3**. These results are based on the initial (baseline) designation of parent location in the Seattle or the Comparison area and don't account for whether children moved during the follow-up period into or out of these areas. There was not a statistically significant difference-in-difference for change in parent's overall consumption of beverages subject to the tax between those living in Seattle versus the Comparison area from baseline to either follow-up or between the 12-month and 24-month follow-up. Ultimately, by 24-month follow-up the average total consumption of total sugary beverages subject to the tax remained similar (<1.3 oz/day) between parents living in Seattle and the Comparison area.

Among the individual taxed beverages, there were no significant differential changes by location for parent consumption of soda/pop with sugar, fruit-flavored beverages with sugar, sports beverages with sugar, or energy beverages with sugar. However, Seattle parents' consumption of prepared/bottled tea or coffee with sugar decreased significantly more relative to parents in the Comparison area from baseline to the 24-month follow-up (significant difference-in-difference of nearly 3 oz/day). By 24-month follow-up, Comparison area parents were consuming on average >1.5 oz/day more of prepared/bottled tea or coffee with sugar than Seattle parents, the largest individual beverage difference at this time point. This seems to be the result of a cumulative decrease in consumption of this beverage type among Seattle parents through each follow-up time point. In contrast, consumption among Comparison area parents decreased similarly from baseline to the 12-month follow-up but increased from the 12-month to 24-month follow-up.

**TABLE 3. PARENT CONSUMPTION OF TAXED SUGARY BEVERAGES IN OUNCES PER DAY BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP BASED ON BASELINE LOCATION (SEATTLE OR COMPARISON AREA) WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=132	12-MONTH n=125	24-MONTH n=129	BEFORE THE TAX n=171	12-MONTH n=159	24-MONTH n=169	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>SUGARY BEVERAGES SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX (TOTAL) IN OUNCES PER DAY</b>	<b>12.71 (14.28)</b>	<b>8.13 (11.37)</b>	<b>6.59 (13.19)</b>	<b>12.95 (19.05)</b>	<b>8.66 (13.67)</b>	<b>7.87 (13.98)</b>	<b>-0.33 (-10.03, 9.37)</b>	<b>-0.98 (-5.48,3.53)</b>	<b>-0.64 (-4.38,3.09)</b>
• SODA/POP WITH SUGAR	3.09 (6.12)	1.94 (3.54)	2.35 (5.96)	4.47 (9.64)	2.42 (5.05)	2.47 (6.27)	0.84 (-2.93,4.60)	1.27 (-0.86,3.39)	0.43 (-1.08,1.94)
• FRUIT-FLAVORED BEVERAGES WITH SUGAR	2.51 (5.55)	1.52 (4.14)	1.05 (4.13)	2.34 (4.78)	1.32 (3.38)	0.72 (1.71)	0.03 (-2.08,2.13)	0.17 (-1.16,1.49)	0.14 (-0.96,1.23)
• PREPARED/BOTTLED TEA OR COFFEE WITH SUGAR	5.57 (9.19)	3.22 (5.27)	2.17 (3.80)	4.20 (7.66)	3.27 (6.70)	3.76 (8.25)	-1.36 (-6.95, 4.24)	-2.95^ (-5.38,-0.52)	-1.59 (-3.71,0.52)
• SPORTS BEVERAGES WITH SUGAR	0.83 (1.87)	0.76 (1.69)	0.42 (1.28)	1.26 (3.75)	0.61 (1.94)	0.55 (3.01)	0.57 (-0.21,1.34)	0.30 (-0.38,0.98)	-0.27 (-0.92,0.39)
• ENERGY BEVERAGES WITH SUGAR	0.71 (2.61)	0.70 (3.27)	0.61 (3.16)	0.69 (3.48)	1.05 (5.54)	0.36 (2.01)	-0.44 (-1.57,0.68)	0.23 (-1.05,1.51)	0.67 (-0.38,1.72)

Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area; ^p<.05

**Table 4** provides results for parent consumption of non-taxed beverages and specifically mostly water beverages. There were no significant difference-in-difference between the Seattle and Comparison area parents from baseline through the follow-up time points for these beverage types.

**TABLE 4. PARENT CONSUMPTION OF NON-TAXED BEVERAGES IN OUNCES PER DAY AND SPECIFICALLY WATER BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP BASED ON BASELINE LOCATION (SEATTLE OR COMPARISON AREA) WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=132	12-MONTH n=125	24-MONTH n=129	BEFORE THE TAX n=171	12-MONTH n=159	24-MONTH n=169	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>ALL BEVERAGES NOT SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX IN OUNCES PER DAY</b>	<b>68.09</b> <b>(36.33)</b>	<b>55.51</b> <b>(29.83)</b>	<b>55.18</b> <b>(32.06)</b>	<b>67.93</b> <b>(33.52)</b>	<b>59.52</b> <b>(32.05)</b>	<b>59.18</b> <b>(31.94)</b>	<b>-4.44</b> <b>(-18.86,9.99)</b>	<b>-3.97</b> <b>(-15.68,7.73)</b>	<b>0.46</b> <b>(-8.49,9.42)</b>
• ALL WATER (TAP, BOTTLED, FLAVORED)	42.30 (28.16)	31.68 (21.79)	32.90 (25.03)	40.05 (24.22)	37.06 (22.95)	37.79 (25.46)	-7.72 (-18.76,3.31)	-7.07 (-15.68,1.54)	0.65 (-5.89,7.19)

Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area.

*Children’s beverage consumption patterns among sample who maintained their location during all periods*

Some children and parents changed their residence from before to after the tax, thus potentially changing their exposure to the Seattle sugary beverage tax. To examine whether this changed the findings reported above, we limited the sample to children and parents who maintained their location status from baseline to both follow-ups - remained living in Seattle the whole time or living outside of Seattle the whole time but still in King County (considered the Comparison area). Families could have moved within Seattle during this period and still be included in the analysis. Similarly, families could have moved within King County, outside of Seattle, and still be included in the analysis. This reduced the sample to 353 children and parents with baseline data, with further reductions in the final analysis sample when removing those with missing values for weighting variables and social desirability adjustment (286 children and parents).

Among this sample that maintained location, there continued to be no significant difference-in-difference in children’s overall consumption of beverages subject to the tax (**Table 5**). The Comparison area children decreased their consumption of fruit-flavored beverages with sugar from baseline through the 24-month follow-up significantly more than Seattle children (1.06 oz/day greater decrease in the Comparison area). This appeared to be the result of higher corresponding starting levels among Comparison area children. Seattle and Comparison area children ended up <0.27 oz/day different by this last follow-up in fruit-flavored beverage consumption. There were no significant difference-in-difference for children’s consumption of all non-taxed beverages and specifically water between those children who maintained residence in Seattle versus retained residence outside of Seattle.

**TABLE 5. CHILD CONSUMPTION OF TAXED SUGARY BEVERAGES AND NON-TAXED BEVERAGES IN OUNCES PER DAY BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP AMONG THOSE MAINTAINING THEIR LOCATION WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=117	12-MONTH n=110	24-MONTH n=114	BEFORE THE TAX n=169	12-MONTH n=158	24-MONTH n=166	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>SUGARY BEVERAGES SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX (TOTAL) IN OUNCES PER DAY</b>	<b>6.13 (7.28)</b>	<b>5.34 (9.07)</b>	<b>5.46 (8.83)</b>	<b>7.10 (9.69)</b>	<b>4.78 (7.06)</b>	<b>4.97 (7.09)</b>	<b>1.60 (-1.66,4.85)</b>	<b>1.55 (-0.59,3.70)</b>	<b>-0.05 (-2.14,2.04)</b>
• SODA/POP WITH SUGAR	2.56 (3.72)	1.75 (3.10)	1.93 (4.47)	2.30 (4.55)	1.84 (3.09)	1.80 (3.36)	-0.35 (-1.78,1.09)	-0.14 (-1.25,0.98)	0.21 (-0.79,1.21)
• FRUIT-FLAVORED BEVERAGES WITH SUGAR	1.61 (3.05)	1.55 (3.36)	1.45 (2.41)	2.38 (4.64)	1.62 (3.38)	1.19 (2.88)	0.71 (-0.39,1.80)	1.06^ (>0.00,2.12)	0.36 (-0.53,1.24)
• PREPARED/BOTTLED TEA OR COFFEE WITH SUGAR	0.70 (1.89)	0.50 (1.42)	0.70 (3.08)	0.82 (2.13)	0.30 (1.33)	0.79 (2.58)	0.34 (-0.33,1.01)	0.04 (-0.42,0.49)	-0.31 (-0.98,0.37)
• SPORTS BEVERAGES WITH SUGAR	1.12 (2.37)	1.13 (2.36)	1.06 (2.58)	1.49 (3.95)	0.88 (1.80)	1.05 (2.29)	0.62 (-0.27,1.51)	0.36 (-0.40,1.12)	-0.26 (-0.87,0.36)
• ENERGY BEVERAGES WITH SUGAR	0.13 (0.45)	0.40 (3.51)	0.33 (1.53)	0.10 (0.82)	0.14 (0.79)	0.13 (0.90)	0.25 (-0.39,0.88)	0.18 (-0.43,0.78)	-0.07 (-0.77,0.63)
<b>ALL BEVERAGES NOT SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX IN OUNCES PER DAY</b>	<b>53.30 (27.17)</b>	<b>44.37 (30.21)</b>	<b>41.71 (22.49)</b>	<b>50.45 (31.43)</b>	<b>45.86 (30.60)</b>	<b>44.38 (30.64)</b>	<b>-3.97 (-13.79,5.84)</b>	<b>-5.31 (-14.48,3.86)</b>	<b>-1.34 (-9.34,6.67)</b>
• ALL WATER (TAP, BOTTLED, FLAVORED)	33.71 (20.58)	25.36 (17.63)	25.59 (16.86)	31.30 (25.48)	28.56 (22.65)	28.51 (24.78)	-5.14 (-13.47, 3.19)	-5.26 (-11.97, 1.45)	-0.12 (-6.43, 6.19)

Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area; ^p<.05

*Parent beverage consumption patterns among sample who maintained their location during all periods*

Among parents who maintained location, there continued to be no significant difference-in-difference between Seattle and the Comparison area in their overall consumption of beverages subject to the tax (Table 6). Unlike findings for parents based on their baseline location status, parents who maintained

their residence in the Comparison area significantly decreased their consumption of sports beverages with sugar from baseline to the 12-month follow-up relative to parents in Seattle (0.87 oz/day greater decrease). This difference-in-difference was not sustained through the 24-month follow-up. Conversely, and consistent with findings using baseline location status, parents who maintained residence in Seattle decreased their consumption of prepared/bottled tea or coffee with sugar from baseline through the 12-month to the 24-month follow-up more than Comparison area parents (1.63 oz/day more decrease). Unlike the findings using baseline status location, this did not result in a significant difference-in-difference from baseline to the 24-month follow-up between Seattle versus Comparison area parents for consumption of prepared/bottle tea or coffee, although the direction of the findings was similar. There were no significant difference-in-difference for the change in parents' non-taxed beverage consumption or for water among these beverages.

**TABLE 6. PARENT CONSUMPTION OF TAXED SUGARY BEVERAGES AND NON-TAXED BEVERAGES IN OUNCES PER DAY BEFORE THE TAX AND 12-MONTH AND 24-MONTH FOLLOW-UP AMONG THOSE MAINTAINING THEIR LOCATION WITH ADJUSTMENT FOR SOCIAL DESIRABILITY**

	SEATTLE RESIDENCE			COMPARISON AREA RESIDENCE			DIFFERENCE--IN-DIFFERENCE*		
	BEFORE THE TAX (BL) n=117	12-MONTH n=110	24-MONTH n=114	BEFORE THE TAX n=169	12-MONTH n=157	24-MONTH n=167	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12-MONTH
<b>SUGARY BEVERAGES SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX (TOTAL) IN OUNCES PER DAY</b>	<b>11.68 (12.99)</b>	<b>7.76 (9.74)</b>	<b>5.78 (10.48)</b>	<b>13.08 (19.15)</b>	<b>8.71 (13.76)</b>	<b>7.97 (14.05)</b>	<b>0.44 (-9.12,9.99)</b>	<b>-0.73 (-5.44,3.97)</b>	<b>-1.17 (-4.68,2.34)</b>
• SODA/POP WITH SUGAR	2.32 (4.9)	1.69 (3.40)	1.76 (5.08)	4.44 (9.20)	2.46 (5.27)	2.39 (6.13)	1.34 (-2.02,4.70)	1.56 (-0.23,3.34)	0.22 (-1.10,1.54)
• FRUIT-FLAVORED BEVERAGES WITH SUGAR	2.18 (4.60)	1.19 (2.23)	0.95 (2.66)	2.46 (4.72)	1.16 (3.04)	0.73 (1.69)	0.32 (-1.23,1.87)	0.51 (-0.64,1.65)	0.19 (-0.54,0.92)
• PREPARED/BOTTLED TEA OR COFFEE WITH SUGAR	4.98 (8.34)	3.41 (5.09)	2.16 (3.27)	4.57 (8.09)	3.09 (6.23)	3.39 (7.39)	0.03 (-4.70,4.77)	-1.60 (-3.72,0.53)	-1.63^ (-3.20,-0.06)
• SPORTS BEVERAGES WITH SUGAR	0.75 (1.74)	0.64 (1.37)	0.32 (0.87)	1.61 (4.51)	0.64 (2.05)	0.55 (2.63)	0.87^ (0.07,1.66)	0.66 (-0.14,1.45)	-0.21 (-0.72,0.30)
• ENERGY BEVERAGES WITH SUGAR	0.68 (2.19)	0.58 (2.61)	0.51 (2.51)	1.02 (4.54)	0.83 (4.75)	0.35 (1.84)	0.04 (-0.75,0.82)	0.49 (-0.59,1.57)	0.45 (-0.34,1.24)
<b>ALL BEVERAGES NOT SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX IN OUNCES PER DAY</b>	<b>66.97 (33.16)</b>	<b>56.33 (31.36)</b>	<b>53.12 (30.19)</b>	<b>68.05 (33.67)</b>	<b>59.50 (32.27)</b>	<b>59.09 (32.09)</b>	<b>-2.33 (-17.04,12.38)</b>	<b>-4.71 (-16.15,6.73)</b>	<b>-2.38 (-11.27,6.51)</b>

• ALL WATER (TAP, BOTTLED, FLAVORED)	41.15 (23.15)	32.79 (22.49)	32.94 (25.71)	39.96 (24.28)	36.91 (23.01)	37.82 (25.62)	-5.42 (-16.68,5.84)	-6.00 (-13.81,1.82)	-0.58 (-7.56,6.41)
--------------------------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------------	------------------------	-----------------------

Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link, with social desirability of the respondent as a covariate; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area; ^p<.05

### Awareness, attitudes, and impact of the SBT

At the 24-month time point, parental awareness and attitudes about Seattle’s Sweetened Beverage Tax was assessed via survey (see Appendix for question and response coding details). Overall, awareness of Seattle’s Sweetened Beverage Tax was significantly higher among parents residing in Seattle (77.5%) versus the Comparison area (64.6%) (overall chi-squared test p=.043). The relatively high rate among both the Seattle and the Comparison area parents suggests high awareness across the region about the tax (Table 7).

TABLE 7. PARENT AWARENESS OF SEATTLE’S SWEETENED BEVERAGE TAX				
			SEATTLE RESIDENCE	COMPARISON AREA RESIDENCE
PARENT AWARENESS OF SBT	YES, AWARE	COUNT	107	115
		PERCENT	77.5%	64.6%
	NO, NOT AWARE	COUNT	28	58
		PERCENT	20.3%	32.6%
	INCONSISTENT/UNAWARE	COUNT	3	5
		PERCENT	2.2%	2.8%

Among those parents who were aware of the tax, there were no significant differences in the level of support/acceptance of the tax between Seattle and Comparison area residents (Table 8). Most parents in both areas were neutral about the tax, neither accepting/supporting nor opposing the tax. Seattle parents were somewhat more opposed (26.5%) than accepting/supportive of the tax compared to Comparison area parents (15.3%) (overall chi-squared test p=.09).

TABLE 8. PARENT ACCEPTANCE OF SEATTLE’S SWEETENED BEVERAGE TAX AMONG THOSE WHO WERE AWARE OF THE TAX				
			SEATTLE RESIDENCE	COMPARISON AREA RESIDENCE
PARENT ACCEPTANCE OF SBT	ACCEPT/SUPPORT	COUNT	5	10
		PERCENT	4.9%	9.0%
	NEUTRAL	COUNT	70	84
		PERCENT	68.6%	75.7%
	OPPOSE	COUNT	27	17
		PERCENT	26.5%	15.3%

At the 24-month time point, parents were also asked about whether they believe they had changed their consumption of sugary beverages in the past few years. The rates were similar between locations, with 50.0% of Seattle parents and 53.8% of Comparison area parents reporting a change in sugary beverage consumption. Among these parents, 83.9% of Seattle parents and 89.5% of Comparison area parents report this change was a decrease in sugary beverage consumption. Parents were also asked what the primary reason was for reducing their sugary beverage consumption, if they reported reducing consumption. **Table 9** details the primary reasons parents indicated they were drinking fewer sugary beverages. There was a significant difference in the primary reasons between parents living in Seattle versus the Comparison area. A higher percentage of Seattle parents (25.5%) indicated that the Sweetened Beverage Tax or cost of sugary beverages was the primary driver of consumption decreases compared to Comparison area parents (1.1%) (overall chi-squared  $p < .001$ ). Health was the most common primary reason for both Seattle and Comparison area parents, although for the overwhelming majority of Comparison area parents this was the primary reason for reducing sugary beverage consumption (94.7% of Comparison area residents).

TABLE 9. PRIMARY REASON PARENTS REPORT FOR DECREASING SUGARY BEVERAGE CONSUMPTION OVER THE PAST FEW YEARS		
	SEATTLE RESIDENCE (n=51)	COMPARISON AREA RESIDENCE (n=94)
<b>REASON</b>		
HEALTH	58.8%	94.7%
SUGARY DRINK TAX OR COST	25.5%	1.1%
TASTE	7.8%	5.3%
CONVENIENCE	5.9%	2.1%
OTHER	1.9%	1.1%

*Community/participant interpretation of beverage consumption change findings*

Consistent with a community-based approach, we were interested in getting participants’ feedback regarding the findings of the observed beverage consumption changes. To do this, we convened remote community meetings (because of the COVID-19 pandemic and to allow for easier access) that included parents and youth from both the Seattle and Comparison area. Participants were not separated by location to encourage conversation between those living in Seattle and the Comparison area. More details about the community events are provided in the Appendix. Of the 330 participants contacted to take part in the community meetings about the beverage consumption findings, 95 Seattle residents (39 adults, 56 youth); 72 Comparison area residents (29 adults, 43 youth) attended one of six Zoom sessions. The major themes (with illustrative quotes in italics) from the community event conversations are described below.

Themes from the observed changes in child beverage consumption:

- Kids and parents are generally becoming more health conscious. Kids are learning about healthy lifestyles at school and on social media.
  - *"In general, we are decreasing sugary consumption, in food too; substituting everything for healthier options"* (Spanish-speaker, Comparison area resident)

- *“Social media is promoting being healthy and fit. Having a healthy body and healthy skin is important to the youth, and they are trying to become healthy” (Somali-speaker, Seattle resident)*
- *“Being healthy and looking good has become popular” (Somali-speaker, Comparison area resident.)*
- Parents are interested both in their child’s health and in saving money for the family, both of which lead to reduced purchasing of SSBs.
  - *“It is expensive to buy sugar for kids and parents, we can’t afford to be broke and sick” (Somali-speaker, Comparison area resident)*
- They also observed that kid’s consumption may have leveled off [at 12-month follow-up and not continued decreasing more to the 24-month follow-up] because there are norms around kids drinking sugar-sweetened beverages and parents don’t want to be too restrictive. Some also pointed out that as kids aged in the study, they may have more independence to purchase drinks without their parents.
  - *“We are busy parents, our kids do great if we stick with the rules, otherwise it is too easy to go back to the bad habits” (Spanish-speaker, Comparison area resident)*
  - *“Our cities in the south [comparison area] were going back to the old habits” (Spanish-speaker, Comparison area resident)*
- There might be different economic support for lower-income families based on location, that could reduce the impact of the tax in Seattle
  - *“Seattle families get more government assistance and food stamp and is easier for them to buy sweet drinks compare to Kent or Federal way families. We do not want to spend our cash on unhealthy food” (Somali-speaker, Comparison area resident)*
  - *“Seattle people have money and comparing area [Comparison area] have limited income and they are on budget they don’t want to spend money sweet beverage” (Somali-speaker, Comparison area resident)*

Themes from responses about parent beverage consumption across all groups:

- Parents noted that consumption may have continued to go down in Seattle because costs of living in Seattle are high and continue to increase. They may be making changes due to financial reasons that Comparison area residents do not feel as much.
  - *“I went down because of health reasons... might have gone down because of tax, everything in Seattle is going up” (English-speaker, Seattle resident)*
- Many parents shared that participating in the study made them want to change habits. Completing the surveys made them more aware of how frequently they were consuming SSBs and they were motivated to decrease them.
  - *“Participating in the study made me think about what we were drinking. Might have reduced because of awareness” (English-speaker, Comparison area resident)*
- Parents indicated that their consumption went down more than their children’s because parents have more autonomy in purchasing. Kids may be served sugar-sweetened beverages at parties, practices, etc. they may also feel peer pressured to have them in ways that parents are not.



- *“Parents are able to follow through to their own actions’ (English-speaker, Comparison area resident)*
- Some parents stated that drinking fewer SSBs helped them to feel healthier, they believe that adults are more likely to notice these changes and may continue to change their habits as a result.
  - *“I feel better drinking water. I now feel bad drinking soda, so I drink more water. Adults feel more of these things in their bodies than kids.” (English-speaker, Seattle resident)*
  - *“We realized we spend a lot of money on sugar” (Somali-speaker, Seattle resident)*

#### Themes about experiences with the tax:

- Many parents reported purchasing fewer SSBs. Some Seattle parents reported driving to Comparison area stores to make purchases. Some Comparison area parents noted that they do not buy SSBs in Seattle when visiting. Many parents reported drinking more water and carrying water bottles with them instead of buying drinks when out.
  - *“Our family have been drinking water only for the past 2 years” (Somali-speaker, Seattle resident)*
  - *“It was my daughter reminding me that we made this pledge to buy water instead” (English-speaker, Comparison area resident)*
- Some parents shared that they were angry about the tax and that they felt it was a punishment or forcing people to be healthy. Parents recalled hearing about the tax in the media, but not a lot of discussion in their friend or family groups. They recalled that it was controversial, and many people were angry.
  - *“When I first heard about it, people were really mad. People didn’t like paying more money... now people don’t even think about it anymore” (English-speaker, Seattle resident)*
- Some parents thought the tax was a good thing and were glad the money was going to good causes to help the community be healthier.
  - *“I used to complain about the tax before but now... I realized how much it’s needed” (Somali-speaker, Seattle resident)*
- Some Comparison area parents did not realize the tax was only on purchases in Seattle.
  - *Why was the tax only implemented in Seattle? (Somali-speaker, Comparison area)*

#### Other themes:

- Parents in all groups reported confusion about where the tax dollars were going. They wanted more transparency from the city about how the money was spent in the end. They had heard it was going to important community programs but didn’t see any evidence of that.
  - *“This money needs to go into food deserts. This money should be going into lower income communities” (English-speaker, Comparison area resident)*
- Parents shared that they were grateful for the opportunity to participate in the study and learn more about their consumption patterns. They indicated that taking part in the study might have impacted their beverage consumption or at least their report of it. They also noted that they would have like an additional educational component to help them change their habits now that they are aware of them.

- *“We are learning how sugar affects our health” (Somali-speaker, Comparison area)*
- *“Maybe we said what we thought you want to hear... everyone wants to be healthy.” (English-speaking, Seattle resident)*
- Some parents noted cultural reasons why different groups consume sugary beverages. They asked that the city share data on more specific groups within the study. Others felt the sample was not representative enough of their own community or that it did not represent other communities they believed have different consumption patterns or experiences with the tax.
  - *“When the community talks a lot about healthy living, we make changes” (Somali-speaker, Seattle resident)*
  - *“Drinking too much sugar is cultural in adults, from our own countries” (Spanish-speaker, Comparison area resident)*
- Some parents were surprised that consumption decreased after the tax was implemented. They were not expecting to see changes as a result of the tax.

## CONCLUSION

While we observed decreases in sugary beverage consumption over time, there were no significant differential changes in average consumption of beverages subject to the Seattle Sweetened Beverage Tax among children and parents from lower-income households living in Seattle versus the Comparison area from before to the 12- and 24-month follow-up after the tax was implemented in January 2018. The decreases observed in both Seattle and the Comparison areas in overall consumption of taxed beverages from before to 12 months after the tax were generally sustained at similar levels through the 24-month follow-up. These results were consistent regardless of whether the sample included all participants based on only their baseline location (Seattle or the Comparison area), or was limited to those participants who maintained their location (Seattle or the Comparison area) throughout data collection from baseline through the follow-ups.

Among children, this Seattle versus the Comparison area lack of difference-in-difference in overall taxed beverage consumption also held for each individual taxed beverage type (e.g., soda, sports beverages) through the last follow-up, with the exception of children’s consumption of fruit-flavored beverages with sugar that decreased more among the Comparison area than Seattle children (about 1 oz/day difference-in-difference from baseline to the 24-month follow-up across models). In contrast, parent’s consumption of prepared/bottled tea or coffee with sugar decreased more significantly among Seattle than Comparison area parents from the pre-tax baseline to 24-months after tax implementation (>2 oz/day difference-in-difference across models), with most of this differential change happening between the 12- and 24-month follow-up. It is not clear why there were differential effects for these individual beverage types for children or parents. It is notable among the taxed beverage types, bottled and prepared tea/coffee was the most consumed beverage type for adults, so there was more room for decreasing its consumption. Further, pass through of the tax for bottled tea was the highest across the taxed beverage types at the 12-month follow-up (115% pass through) and bottled coffee was the 3<sup>rd</sup> highest pass through at that point (97% pass through). It could be that parents were sensitive to this particularly higher increase in prices, although the rates of pass through for these beverage types were attenuated at the 24-month time point. It is also notable that neither of the differential changes in these individual sugary beverage types between Seattle and Comparison area children or parents resulted in significant differential changes from before to 2 years after the tax in overall consumption of sugary beverages subject to the Seattle Sweetened Beverage Tax. Both children and parents also decreased

similarly their reported consumption of beverages not subject to the tax, including water, in Seattle and the Comparison area from before to after the tax.

These findings based on reported individual beverage consumption and the combination of individual beverage consumption are consistent with the findings based on the 24-month survey question about participants' perceptions of the change in consumption. Approximately half of parents in each location indicated they had changed their sugary beverage consumption in the past few years, with most decreasing consumption. Seattle parents were more likely to report that the tax or cost were the primary reason for consumption decreases, whereas Comparison area parents reported health as the primary reason.

As in the previously reported 12-month report, the lack of differential change in overall consumption of beverages subject to the tax in Seattle between those living Seattle versus living outside of Seattle was unexpected. The findings from the beverage price audit done in stores and restaurants by our team highlight continued markedly higher prices for the taxed beverages in Seattle stores compared to prices in Seattle at baseline (before the tax) and compared to prices in Comparison area stores through the follow-up period.<sup>1</sup> Further, Powell and colleagues study of purchase data suggests that the volume purchased of such beverages decreased in Seattle stores relative to similar stores in the Portland area which has no sugary beverage tax.<sup>2</sup>

As described in our report on changes in reported child and parent beverage consumption associated with the Seattle SBT 12 months after the tax, the evidence to date then suggested inconsistent findings on whether and how much beverage consumption changed in response to SBTs in studies in other parts of the U.S. and around the world. Evidence in the past few years about consumption changes continues to be mixed. Some studies find relative decreases in sugary beverage consumption in areas with a SBT compared to surrounding or similar non-taxed areas, whereas others find no difference in the change in sugary beverage consumption from before to after the tax is implemented between taxed and non-taxed areas. In their 2021 study, Edmondson and colleagues found that high schoolers in Philadelphia (taxed area) had greater decreases in reported weekly soda consumption from before to after tax implementation compared to high schoolers from 7 non-taxed areas, with particularly large relative decreases among Hispanic/Latinx youth and youth with overweight/obesity.<sup>3</sup> In contrast, in their 2020 study of Oakland's SBT, Cawley and colleagues found no differential change in consumption of sugary beverages from before to after the tax among children or adults in households shopping in stores in Oakland versus households shopping in stores in the area surrounding Oakland.<sup>4</sup> Similarly, in a follow-up to their earlier study, Zhong and colleagues in their 2020 study found that 12 months after the Philadelphia SBT, adult residents in Philadelphia had decreased their sugary beverage consumption, but not differently than decreases among adult residents in surrounding non-taxed cities.<sup>5</sup> A 2022 meta-analysis by Andreyeva and colleagues, which examines evidence across various studies (including by our team), finds that sugary beverages taxes overall increase sugary beverage prices in taxed areas and reduce sales/purchase of these beverages in taxed areas, but do not overall reduce more the reported consumption of sugary beverages among residents in taxed versus non-taxed areas.<sup>6</sup>

It is possible that the decreases in sugary beverage consumption in the present study among both Seattle and Comparison area youth and parents reflects a general secular trend in reduced sugary beverage consumption.<sup>7</sup> This highlights the need to continue to use a multi-pronged evaluation approach (e.g., look at consumption changes, prices changes, purchase changes) when examining sugary beverage and other food and beverage taxes. For an examination of consumption changes, this would ideally include on-going and representative surveillance of sugary beverage consumption (and diet

quality overall) to a) potentially minimize reactivity to measurement that may increase during times of tax consideration and awareness, b) allow for subgroup analysis by sociodemographic factors, such as household income, and c) better establish the estimate of parallel trends before tax implementation.

The community perspectives obtained during our community meetings provide some insight into why consumption may have decreased overall and not necessarily differentially based on location. Participants in these community meetings interpreted these findings as being reflective of a general health consciousness particularly among parents for their children, as well as the need to save money by not purchasing sugary beverages regardless of whether they are taxed. Parent and child experiences with the tax were mixed, and many attributed the changes in consumption data to factors other than the tax such as health education, increased cost of living, or the practice of participating in study surveys. We intentionally did not highlight or query in the survey about the tax or its potential impacts until the final surveys in the 24-month data collection, but perhaps completion of multiple beverage survey across 2 years heightened respondents' awareness of their consumption. This alone could have led to changes in consumption for both Seattle and Comparison area residents. Many participating families report making changes to their shopping and consumption habits after the tax went into effect. Differences in patterns between kids and parents, perhaps particularly around prepared/bottled tea or coffee, may be due to norms or appeal around which sugar-sweetened beverages are consumed by children versus adults and perhaps differences in autonomy between kids and parents. As noted in the 12-month report, the shared information, news, and other media in the Seattle and Comparison area could have contributed to the similar effects observed in change in beverage consumption. Qualitative findings from recently completed (in January 2023) individual interviews with community members have the potential to improve our understanding of beverage consumption changes and families' experience of the SBT.

The 24-month survey data and community events suggested that most parents were aware of the tax, although this awareness was higher among parents living in Seattle. The community meeting findings suggested parents and children reported hearing and experiencing different things about the tax. Some were angry about or had heard others being angry about it, although the survey data suggested most people were neutral in their acceptance of the tax. Others were glad for it and knowing the money was going to important programs. Generally, participants wished for more transparency around the tax after implementation and they wanted to know where the money was going. These findings are consistent with a 2022 examination by Edmondson and colleagues of the perceptions among low-income parents of the Philadelphia SBT. There was high awareness of the Philadelphia SBT among these parents, along with a perception of the tax being fair so long as tax revenue was used to support community-valued programs (e.g., pre-K and other school programs) and there was accountability for how the tax revenue was used.<sup>8</sup> The 24-month survey data are also consistent with findings from our team about perceptions of sugary beverage taxes among a different sample of Seattle adults and adults from comparison areas in other parts of the country. In that study, adults with lower incomes had more favorable perceptions of the tax over time, with an increase in support of the tax and belief it would have a positive effect on public health. In contrast, perceptions among adults with higher incomes shifted to be more negative about the tax and its impacts.<sup>9</sup> Lower-income Seattle residents also increased their perceptions of the potential negative health effects of sugary beverage consumption from before to after the SBT went into effect, with few and less change among higher-income residents.<sup>10</sup>

## **STRENGTHS AND LIMITATIONS**

There were numerous strengths to the conduct of this 24-month follow assessment, including:

- Consistent with a cohort design, we continued to survey the same lower-income families, in order to examine individual-level changes in beverage consumption over time
- To our knowledge, the 24-month follow-up is among the longest durations of post-tax follow-up to be conducted
- Our community events were well-attended by the cohort participants and illuminated some of the potential reasons for the observed reported beverage consumption changes
- The measurement and adjustment in analyses for general social desirability responding

There are also some notable limitations to this 24-month follow-up assessment, including:

- The challenge in retaining the same sample of lower-income families across 2+ year period
- The lack of geographic or demographically representative sample of residents within Seattle or within the Comparison area, although the inclusion of lower-income samples of families in both areas and the propensity score weighting process sought to make the samples in the Seattle and Comparison area more comparable
- The single instance self- or other-report nature of beverage consumption at each time point
- The community meetings were attended together by Seattle and Comparison area residents, making it not possible to have collective conversations among those who shared location
- The additional questions about tax effects and perceived changes in consumption only queried parents and teens, not younger children
- The focus of the study (and the survey questions) was generally not to explore reasons why people consume sugary beverages or to more completely understand the reasons why people change consumption behaviors; there is growing evidence that education and/or other policies and messaging could accompany SBTs to potentially have a bigger effect on changing consumption
- The community events and findings from them should be considered only the start of conversations about how factors other than taxes or price impact adults' and children's beverage consumption; for example, it was noted that culture (family and/or community culture) or specific events centered around sugar-sweetened beverages would continue even in the face of increasing prices

## REFERENCES

1. Jones-Smith JC, Pinero Walkinshaw L, Oddo VM, et al. Impact of a sweetened beverage tax on beverage prices in Seattle, WA. *Econ Hum Biol.* Jul 23 2020;39:100917. doi:10.1016/j.ehb.2020.100917
2. Powell LM, Leider J. The impact of Seattle's Sweetened Beverage Tax on beverage prices and volume sold. *Econ Hum Biol.* May 2020;37:100856. doi:10.1016/j.ehb.2020.100856
3. Edmondson EK, Roberto CA, Gregory EF, Mitra N, Virudachalam S. Association of a Sweetened Beverage Tax With Soda Consumption in High School Students. *JAMA Pediatr.* Dec 1 2021;175(12):1261-1268. doi:10.1001/jamapediatrics.2021.3991
4. Cawley J, Frisvold D, Hill A, Jones D. Oakland's sugar-sweetened beverage tax: Impacts on prices, purchases and consumption by adults and children. *Econ Hum Biol.* May 2020;37:100865. doi:10.1016/j.ehb.2020.100865
5. Zhong Y, Auchincloss AH, Lee BK, McKenna RM, Langellier BA. Sugar-Sweetened and Diet Beverage Consumption in Philadelphia One Year after the Beverage Tax. *Int J Environ Res Public Health.* Feb 19 2020;17(4)doi:10.3390/ijerph17041336
6. Andreyeva T, Marple K, Marinello S, Moore TE, Powell LM. Outcomes Following Taxation of Sugar-Sweetened Beverages: A Systematic Review and Meta-analysis. *JAMA Netw Open.* Jun 1 2022;5(6):e2215276. doi:10.1001/jamanetworkopen.2022.15276
7. Lee MM, Altman E, Madsen KA. Secular Trends in Sugar-Sweetened Beverage Consumption Among Adults, Teens, and Children: The California Health Interview Survey, 2011-2018. *Prev Chronic Dis.* Feb 18 2021;18:E12. doi:10.5888/pcd18.200399
8. Edmondson EK, Shea JA, Gregory EF, et al. Low-income parents' perceptions of a sweetened beverage tax in Philadelphia. *J Nutr Sci.* 2022;11:e67. doi:10.1017/jns.2022.64
9. Oddo VM, Knox MA, Pinero Walkinshaw L, Saelens BE, Chan N, Jones-Smith JC. Evaluation of Seattle's sweetened beverage tax on tax support and perceived economic and health impacts. *Prev Med Rep.* Jun 2022;27:101809. doi:10.1016/j.pmedr.2022.101809
10. Sawyer L, Oddo VM, Fretts A, et al. Impacts of the Seattle Sweetened Beverage Tax on the Perceived Healthfulness of Sweetened Beverages. *Nutrients.* Feb 26 2022;14(5)doi:10.3390/nu14050993

## APPENDIX: CHILD COHORT 24-MONTH DESIGN, SAMPLE, AND METHODS

### Design

The design of the child cohort component to evaluate beverage consumption in response to the Seattle SBT is a longitudinal cohort design. The particular strength of the longitudinal design is the measurement of the same people over time. This design reduces the potential influence of unmeasured and stable individual-level factors that might be influencing beverage consumption. Many evaluations of sugar-sweetened beverage tax consumption used serial cross-sectional designs which measure consumption among different people at different time points, such as before and after a tax.

We named the child cohort evaluation component SeaSAW (Seattle Shopping and Wellness), so families had an easy way to refer to it. SeaSAW children/families include those children/families residing in the City of Seattle or, for comparison purposes, residing in nearby cities in South King County. Families initially recruited into SeaSAW had a lower-income (<312% Federal Poverty Level or FPL) and a 7-10 or 12-17 year old child. Families had to indicate that this child does consume sugary beverages, that is they are not among those who never consume such beverages. Full details about the baseline sample and methods and 12-month child cohort consumption change results are available on the City of Seattle (<https://www.seattle.gov/sweetened-beverage-tax-community-advisory-board/evaluation-reports>).

### Sample

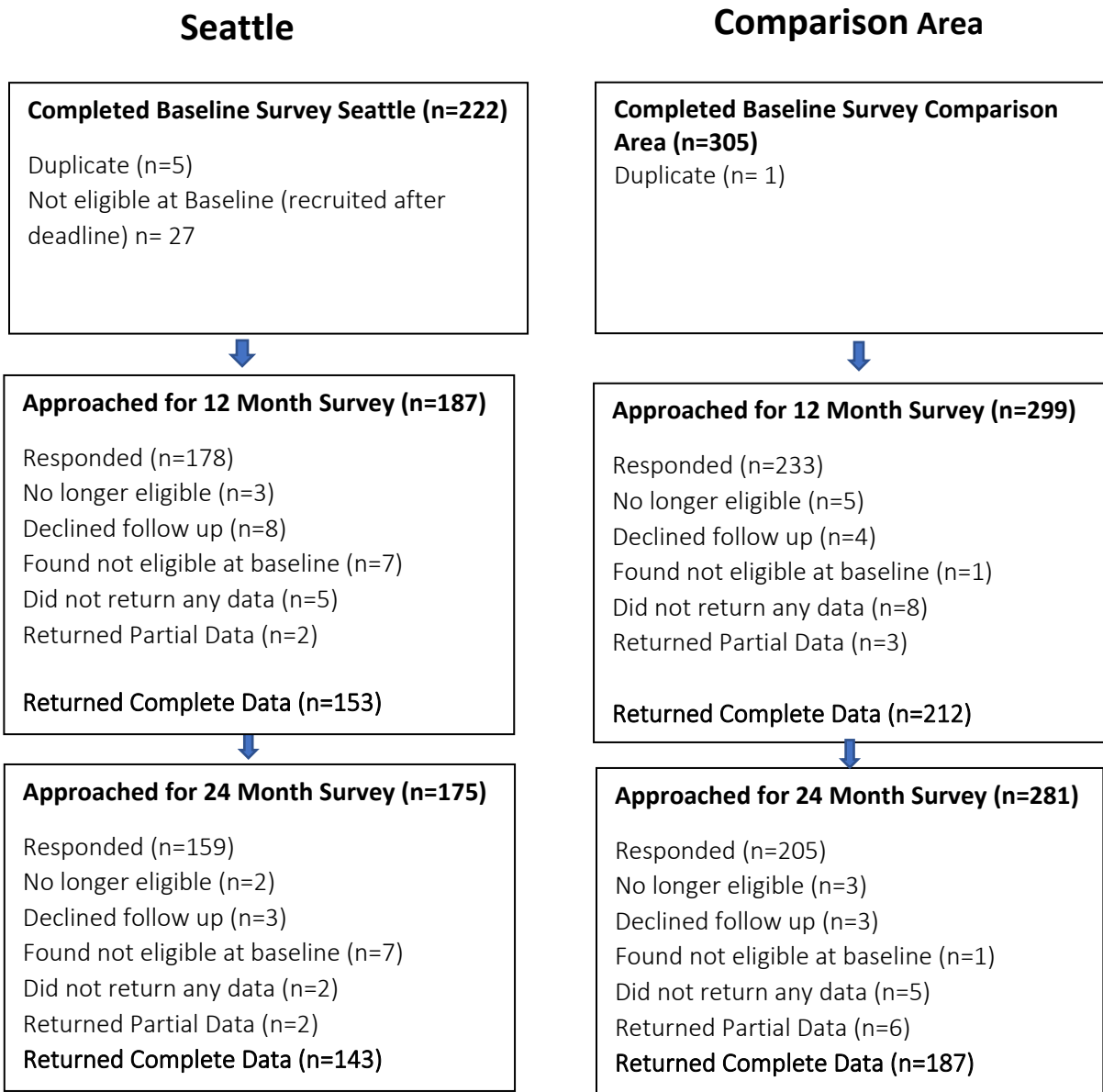
Timeline and re-contacting families. Follow-up for the 24-month child cohort follow-up began on November 10<sup>th</sup>, 2019 and ended February 28<sup>th</sup>, 2020. The start date was slightly delayed due to the addition of the two new surveys which required human subjects protection/IRB approval. All participants who completed baseline data collection were approached at all follow up time points, including the 24-month follow-up, unless they declined to participate, were no longer be eligible for participation, or shared information that revealed they had not been eligible in the first place (e.g., providing incorrect age information about their child at baseline).

The strategies for re-contacting families and collecting the follow-up data included:

- Families first received a re-contact letter inviting them to participate in the follow up. This letter included a link to be able to complete the follow-up surveys online. It also provided instructions for contacting the team if they wished to complete the survey by a different mode (phone or paper). Participants who requested paper surveys for 6- or 12-month follow up points were automatically sent paper packets in their language of choice with their 24-month recontact letter.
- After re-contact letters were sent, the research team contacted the participating families with reminder calls, texts, and emails at regular intervals to prompt survey completion.
- If surveys were not completed after several weeks, and contact had not been made with the participating parent/caregiver, paper survey packets were prepared for each family and delivered to their address.
- Based on the advice of community outreach workers, we arranged individual meetings or small events in community spaces to provide families an opportunity to complete their surveys in person with staff support.
- We re-visited regular distribution times at the foodbanks where we had recruited some families at baseline, to see if we might better connect with them there to complete surveys.

Families were re-contacted for the 24-month follow up in their respective languages. Each family had an assigned data collection “target date” which was exactly two years after their baseline data collection

date. Two weeks prior to their target date, families were sent a letter in the mail inviting them to participate in the follow up with a link to complete their surveys online on their target date. Contact information for the team was also provided in case families preferred to complete the surveys via another format. Families that historically preferred to complete their surveys on paper were sent the complete set of paper surveys with the letter. After the initial letter was sent, families received the same information via an email and a short text message. Families received multiple reminders to complete surveys. Families who missed their target date were followed up with periodically via phone, text and email until study collection was over or until it became clear that the family was not responding. For those who did not respond to any outreach, a paper survey packet was distributed to their most recent address and the study team contacted the alternate contacts provided by the participants in their most recent contact forms. Families received a \$50 gift card as a thank you for their participation. The flow chart for participant engagement and survey completion is provided below.





Overall, we had a 77% (384/494) complete survey response rate at 6-month follow-up for eligible families and a 75% (365/486) complete survey response at 12-month follow-up for eligible families, and 72% (330/456) at 24-month follow up for eligible families. Completed surveys for the 24-month follow-up were accepted through the end of March 2020 to account for time in the mail, and thus preceded the start of the COVID-19 pandemic effects in the U.S. and our region. Of 456 families available for follow up (those who did not decline and were still eligible based on past waves), 354 (77%) responded to our outreach and agreed to do the survey. Among these, 336 (73%) completed all or part of the surveys (330 complete, 6 partial). In addition, six families declined and five were ineligible at this time point. This compares favorably to the total sample sizes available at the 6-month (n=384) and 12-month (n=365) follow-ups. In addition, the 24-month sample is similar demographically to the baseline and prior follow-up samples (**Appendix Table 1**).

<b>APPENDIX TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF CHILD COHORT PARTICIPANTS</b>						
	<b>BASELINE</b>		<b>24 MONTH RESPONDENTS FULL SAMPLE</b>		<b>24 MONTH RESPONDENTS WHO DID NOT MOVE</b>	
	<b>SEATTLE</b>	<b>COMPARISON AREA</b>	<b>SEATTLE</b>	<b>COMPARISON AREA</b>	<b>SEATTLE</b>	<b>COMPARISON AREA</b>
	n=181	n=283	n=140	n=184	n=125	n=181
<b>CHILD AGE</b>	10.3 (2.8)	10.4 (3.0)	12.3 (2.8)	12.3 (2.9)	12.3 (2.8)	12.3 (2.9)
<b>CHILD SEX (% FEMALE)</b>	49.17	48.4	47.1	46.7	48.0	47.5
<b>CHILD RACE/ETHNICITY (%)</b>						
- <i>HISPANIC/LATINO</i>	20.4	31.4	22.1	35.3	20	34.8
- <i>WHITE (NON-HISPANIC/LATINO)</i>	16.6	23.3	15.0	20.1	13.6	20.4
- <i>ASIAN (NON-HISPANIC/LATINO)</i>	7.7	4.2	7.9	2.7	8.8	2.8
- <i>BLACK/AFRICAN-AMERICAN/AFRICAN (NON-HISPANIC/LATINO)</i>	42.0	24.0	41.4	23.9	43.2	23.8
- <i>AMERICAN INDIAN OR ALASKA NATIVE (NON-HISPANIC/LATINO)</i>	0.6	0.4	0.7	0.0	0.8	0.0
- <i>NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER (NON-HISPANIC/LATINO)</i>	0.0	2.5	0.0	1.1	0	1.1
- <i>TWO OR MORE RACES (NON-HISPANIC/LATINO)</i>	10.5	10.2	10.0	13.6	10.4	13.8
- <i>RACE/ETHNICITY NOT REPORTED</i>	2.2	3.5	2.9	3.3	2.4	3.3
<b>PARENT AGE AT BASELINE (YEARS)</b>	40.8 (9.0)	38.2 (8.0)	40.8 (8.8)	37.9 (7.1)	40.8 (8.7)	37.9 (7.1)
<b>PARENT SEX (% FEMALE)</b>	82.3	90.4	83.6	94.5	82.4	92.8
<b>HIGHEST LEVEL OF EDUCATION OF ANY ADULT IN THE HOUSEHOLD (%)</b>						

- DID NOT COMPLETE HIGH SCHOOL	11.0	6.7	10.7	7.6	11.2	7.7
- COMPLETED HIGH SCHOOL OR GED	21.5	25.4	19.3	21.7	19.2	22.1
- SOME COLLEGE OR VOCATIONAL TRAINING	28.7	31.8	30.7	32.1	29.6	31.5
- COMPLETED COLLEGE OR UNIVERSITY	20.4	25.8	20.7	27.2	20	27.1
- COMPLETED GRADUATE OR PROFESSIONAL DEGREE	9.4	7.4	9.3	8.7	9.6	8.8
- DID NOT ANSWER	8.8	2.5	9.3	2.7	9.6	2.8
<b>HOUSEHOLD INCOME (%)</b>						
- <130% 2022 FEDERAL POVERTY LEVEL	68.8	47.3	57.1	45.1	58.4	45.9
- 130%-200% 2022 FEDERAL POVERTY LEVEL	10.6	14.8	15.0	16.8	15.2	16.0
- 200%-312% 2022 FEDERAL POVERTY LEVEL	12.7	25.8	16.4	20.7	16	20.4
- >312% 2022 FEDERAL POVERTY LEVEL*	NA	NA	5.7	10.3	5.6	10.5
- DID NOT ANSWER	3.7	11.7	5.7	7.1	4	7.2
<b>FOOD SECURITY (% RESPONDED "OFTEN" OR "SOMETIMES" IN THE PAST MONTH)</b>						
- WORRIED ABOUT FOOD RUNNING OUT	56.9	43.5	46.4	46.2	45.6	45.9
- FOOD RAN OUT AND NOT HAVE MONEY TO BUY MORE	51.9	40.3	37.9	40.2	37.6	40.3
- HARD TO BUY HEALTHY FOODS	58.6	46.3	47.1	51.1	48	50.8

Note. Values are percentages or means (standard deviations). \*Not applicable at baseline, as household income below 312% of the federal poverty level was part of eligibility.

## Methods

**Surveys.** To ensure comparability over time, we did not substantially change the survey methods used to measure children's and parent's beverage consumption from baseline to the 6-, 12-, or 24-month follow-ups. Other data collection at follow-ups was identical to baseline with a few exceptions. In the follow-up data collection, we added a Household Contact Information Questionnaire, which requested more in-depth contact information from families, including back-up contacts, to enhance our ability to contact families for continued planned follow-ups. We also added questions to the Household Information Survey about 1) parent work location, to assess the potential for cross-border shopping, based on the idea that parents working outside of Seattle but living in Seattle may purchase beverages outside of Seattle, near their work location, to avoid the Sweetened Beverage Tax, 2) participation in food assistance programs (e.g., Fresh Bucks) to better understand food access needs and participation in

these programs of this sample, and 3) child oral health to obtain a general assessment of children’s oral health over time, which may be impacted by changes in sugary beverage consumption.

At the 24-month timepoint we also added a questionnaire about general social desirability (the likelihood that respondents will report behaviors or attitudes that are generally known to be perceived as more favorable by others), due to concerns that social desirability may impact how respondents reported on their and their child’s beverage and dietary habits. We also asked parents and teens to complete a survey at the 24-month timepoint about their recollections of the sugary beverage tax and if it impacted their beverage consumption choices. The measures collected at each time point are provided in **Appendix Table 2**.

APPENDIX TABLE 2. DATA OBTAINED AT EACH TIMEPOINT					
SURVEY	MEASURE	BASELINE	6-MONTH	12-MONTH	24-MONTH
ADAPTED BEV-Q (CHILD OR TEEN)	CHILD CONSUMPTION OF 19 DIFFERENT BEVERAGES IN THE PAST MONTH (FREQUENCY AND HABITUAL VOLUME)	√	√	√	√- ADDED QUESTION TO TEEN SURVEY ABOUT THEIR EATING AND DRINKING HABITS HAD CHANGED
ADAPTED BEV-Q (PARENT)	PARENT CONSUMPTION OF 19 DIFFERENT BEVERAGES, INCLUDING ALCOHOL, IN THE PAST MONTH (FREQUENCY AND HABITUAL VOLUME)	√	√	√	√
DIETARY SCREENER QUESTIONNAIRE	CHILD DIETARY SCREENER BASED ON CONSUMPTION OF 25 DIFFERENT FOODS AND BEVERAGES IN THE PAST MONTH (FREQUENCY)	√	√	√	√
HOUSEHOLD INFORMATION SURVEY	DEMOGRAPHIC AND OTHER HOUSEHOLD INFORMATION	√	√- ADDED QUESTIONS ABOUT ORAL HEALTH, PARTICIPATION IN VARIOUS LOCAL FOOD ASSISTANCE PROGRAMS AND PARENTAL WORK LOCATION (IF APPLICABLE)	√	√- ADDED QUESTIONS ABOUT IF PARENT OR CHILD EATING AND DRINKING HABITS HAD CHANGED
ACTIONS, ATTITUDES AND EXPERIENCES- PARENT	SOCIAL DESIRABILITY SCALE- CROWNE AND MARLOWE SHORT FORM				√

ACTIONS, ATTITUDES AND EXPERIENCES- TEEN	CHILDREN'S SOCIAL DESIRABILITY SCALE, ADAPTED FROM BAXTER ET AL.				√
ADDITIONAL QUESTIONS ABOUT DRINKS- PARENT	PARTICIPANT REPORT IF BEVERAGE CONSUMPTION PATTERNS HAD CHANGED AND WHETHER IT WAS ASSOCIATED WITH THE SBT. ADDITIONAL QUESTIONS ABOUT EXPERIENCES WITH THE TAX.				√
ADDITIONAL QUESTIONS ABOUT DRINKS- TEEN	PARTICIPANT REPORT IF BEVERAGE CONSUMPTION PATTERNS HAD CHANGED AND WHETHER IT WAS ASSOCIATED WITH THE SBT. ADDITIONAL QUESTIONS ABOUT EXPERIENCES WITH THE TAX.				√

Surveys were available in English, Somali, and Spanish, in multiple modes -- online, by phone, or on paper. Vietnamese language materials were available at baseline, but we did not enroll any Vietnamese speaking families then who preferred completing the surveys in Vietnamese. We purposefully limited participant burden by keeping survey items to a minimum. To try not to influence responses or create bias, we purposefully did not ask questions about the City of Seattle Sweetened Beverage Tax or its perceived impact on beverage consumption until the 24-month follow-up. These surveys about the tax were provided to participants after they completed the beverage consumption portion of their survey packet.

Calculating beverage consumption. The beverage survey queries about individual beverage consumption in the past month. Child and parent beverage consumption was calculated for each of the individual beverages on the questionnaire, with 19 beverages queried for children and 22 for parents (includes 3 questions about different types of alcohol). Consumption is based on the response to frequency (options being “never or less than 1 time per week”, “1 time per week”, “2-3 times per week”, “4-6 times per week”, “1 time per day”, “2+ times per day”, or “3+ times per day”) and the typical volume each time (options being “less than 6 fl oz (3/4 cup) size of most juice boxes”, “8 fl oz (1 cup)”, “12 fl oz (1½ cup) size of a regular can of soda/pop”, “16 fl oz (2 cups) size of most sports drinks or bottled drinks”, or “More than 20 fl oz (2½ cups)”) for each beverage. A snapshot of a portion of the beverage questionnaire (assessing 5 of the beverage types queried) is provided below (**Appendix Figure 1**).

Based on the survey response to how often the type of beverage was consumed, the frequency was converted to times per day (e.g., “1 time per week” = 0.14 times per day), with the “never or less than 1 time per week” set to 0 times per day. Daily consumption in ounces for each beverage was then calculated by multiplying the frequency per day by the typical volume consumed (e.g., “2+ times per day” X “12 fl oz” = 24 oz per day for that beverage type). Taxed beverage consumption was the sum of daily fluid ounce consumption of 1) fruit-flavored beverages with sugar, 2) soda/pop with sugar, 3) prepared/bottled tea or coffee with sugar, 4) energy beverages with sugar, and 5) sports beverages with sugar. These beverage types were subject to the Seattle Sweetened Beverage Tax. Daily consumption of the remaining beverages on the questionnaire was summed to calculate the daily fluid ounce consumption of non-taxed beverages. For most individuals and most individual beverages, we derived consumption from their responses on the beverage questionnaire. However, 2.3% of children’s

beverages had missing consumption values at baseline (i.e., missing frequency or habitual volume responses for a beverage) and 1.0% were missing values at the 6-month follow-up and values at the 6-month follow-up and <1% at 12-month follow-up. Parents were missing 2.7% of beverage consumption values at baseline, 1.0% at 6-month follow-up, and <1.0% at 12-month follow-up. At 24 month follow up, 1.9% of children’s beverages had missing data and <1.0% of parent’s beverages had missing data. Therefore, we explored and implemented a data-driven process to fill in or impute missing values among individual beverages.

**APPENDIX FIGURE 1. SNAPSHOT OF BEVERAGE QUESTIONNAIRE**

Type of Beverage	A) How Often Do You Drink It? (Choose One)							B) How Much Each Time? (Choose One)				
	Never or less than 1 time per week- go to next beverage	1 time per week	2-3 times per week	4-6 times per week	1 time per day	2+ times per day	3+ times per day	Less than 6 fl oz (3/4 cup) Size of most juice boxes	8 fl oz (1 cup)	12 fl oz (1 3/4 cups) Size of a regular can of soda/pop	16 fl oz (2 cups) Size of most sports drinks or bottled drinks	More than 20 fl oz cups (2 3/4 cups)
1. Tap water												
2. Plain bottled water (e.g., Aquafina, Dasini, Smart Water)												
3. Flavored water without added sugar or other caloric sweeteners (e.g., coconut water, club soda or bubbly water; aqua frescas without sugar or other caloric sweeteners such as honey) or other flavored waters with low or no calories (e.g., La Croix, Mio, Vitamin Water Zero, Sobe Life Water)												
4. 100% Fruit juice (e.g., orange, apple, Honest Kids)												
5. Fruit-flavored drinks with added sugar that are ready to drink – in bottle/can or from a drink fountain/dispenser (e.g., lemonade, Sunny Delight, Hawaiian Punch)												

Some participant’s survey data was excluded from analysis at some timepoints due to total beverage consumption that was very low or very high (<1% or >99% percentile based on the frequencies of total consumption across all time points). We also recategorized 35 families from living in “Seattle” to living in the “Comparison area” because although they reported living in Seattle and had a Seattle mailing address, their home address was located in unincorporated parts of King County, just outside Seattle. Finally, the propensity score weighting process eliminates respondents without complete data for all of the variables included in the process. After removing outliers and propensity scoring our final full analytic sample was 437 for those who location designation was based on baseline residence only. After eliminating participants who changed exposure location (moved from Seattle to outside of Seattle or moved from the Comparison area into Seattle), the subgroup sample was 353.

Data analysis. We used similar propensity score weighting methods and outcomes analysis methods as in the 12-month analysis report. Propensity score weights were not changed, as they were based on baseline demographics and baseline beverage consumption. We fit generalized estimating equations with the outcomes of taxed beverage consumption, all non-taxed beverage consumption, and water consumption (separate models for child and parent) for both the sample defined by baseline location (Seattle or the Comparison area) and for the subgroup sample defined as staying in their baseline

location (Seattle or the Comparison area) from baseline through both 12- and 24-month follow-ups. The main model results included social desirability as a covariate. In **Appendix Table 3** below, findings from models of child and parent consumption of sugary beverages subject to the tax, without adjustment for social desirability are presented. Findings are mostly similar to those with social desirability adjustment, with neither children nor parents having differential change in overall sugary beverage consumption by location (Seattle versus Comparison area) from before to after the tax. Children in the Comparison area reduced their fruit-flavors beverage consumption significantly more than Seattle children between baseline and 24-month follow-up, a difference-in-difference not observed in the adjusted model. Similar to the adjusted model, parents in Seattle reduced their consumption of prepared/bottled tea or coffee with sugar more than Comparison area parents from baseline to the 24-month follow-up. In these unadjusted analyses, there was an additional significant finding of a greater decrease from the 12-month to the 24-month follow-up in the consumption of this beverage type by Seattle parents.

**APPENDIX TABLE 3: DIFFERENCE-IN-DIFFERENCES IN SUGARY BEVERAGE CONSUMPTION BETWEEN LOCATION OVER TIME BASED ON BASELINE LOCATION STATUS, WITHOUT ADJUSTMENT FOR SOCIAL DESIRABILITY**

	CHILDREN'S BEVERAGE CONSUMPTION DIFFERENCE-IN-DIFFERENCE			PARENT'S BEVERAGE CONSUMPTION DIFFERENCE-IN-DIFFERENCE		
	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12- MONTH	12-MONTH VS. BL	24-MONTH VS. BL	24-MONTH VS. 12- MONTH
<b>SUGARY BEVERAGES SUBJECT TO THE SEATTLE SWEETENED BEVERAGE TAX (TOTAL) IN OUNCES PER DAY</b>	<b>1.24</b> (-1.05, 3.88)	<b>1.86</b> (-0.54, 4.25)	<b>0.61</b> (-1.88, 3.11)	<b>2.62</b> (-1.04, 6.28)	<b>1.02</b> (-2.08, 4.85)	<b>1.59</b> (-5.58, 2.39)
• SODA/POP WITH SUGAR	-0.48 (-1.51, 0.55)	0.24 (-0.84, 1.31)	0.72 (-0.41, 1.84)	1.18 (-0.45, 2.82)	1.64 (-0.07, 3.35)	0.45 (-1.32, 2.23)
• FRUIT-FLAVORED BEVERAGES WITH SUGAR	0.78 (-0.19, 1.74)	1.05 <sup>^</sup> (-1.06, 1.99)	0.28 (-0.77, 1.33)	0.41 (-0.78, 1.59)	0.47 (-0.77, 1.71)	0.07 (-1.23, 1.36)
• PREPARED/BOTTLED TEA OR COFFEE WITH SUGAR	0.62 (-0.03, 1.26)	0.28 (-0.39, 0.95)	-0.37 (-1.04, 0.36)	-0.27 (-2.03, 1.49)	-2.26 <sup>^</sup> (-4.10, -0.42)	-1.99 <sup>^</sup> (-3.91, -0.07)
• SPORTS BEVERAGES WITH SUGAR	0.18 (-0.60, 0.95)	0.11 (-0.70, 0.92)	-0.06 (-0.91, 0.78)	1.54 <sup>^</sup> (0.78, 2.29)	0.76 (-0.03, 1.55)	-0.77 (-1.60, 0.05)
• ENERGY BEVERAGES WITH SUGAR	0.38 (-0.23, 0.99)	0.40 (-0.23, 1.04)	0.02 (-0.65, 0.69)	-0.17 (-1.22, 0.87)	0.48 (-0.61, 1.57)	0.65 (-0.49, 1.79)

*Note. Estimates are mean ounces per day with standard deviations provided in parentheses for timepoint estimates in Seattle and the comparison and 95% confidence intervals provided for difference-in-difference values; \*Difference-in-difference values are estimated change in Seattle minus change in Comparison area based on propensity-score weighted generalized estimating models with gaussian distribution and identity link; difference-in-difference values closer to zero suggest no difference in changes from before the tax to after the tax in Seattle versus Comparison area; positive values are in the direction of less change in Seattle than the Comparison area and negative values in the direction of more change in Seattle than the Comparison area; <sup>^</sup>p<.05*

Parental tax awareness. To assess parents' awareness and perceptions of the SBT, parents were asked the following questions in the 24-month follow-up survey:

- *What do you remember seeing, hearing, or reading about the sugary drink tax? (if nothing, write 'nothing')*
- *What has been your experience with the sugary drink tax? (if nothing, write 'nothing')*
- *Describe any changes you've made in buying or drinking sugary drinks since the tax went into effect? (if none, write 'none')*

We inductively developed a codebook to analyze the free text responses to code for SBT awareness. We conducted preliminary data cleaning before coding participants responses. The data cleaning steps were to:

1. Translate all Somali and Spanish responses into English
2. Remove responses that are nonsensical (text/open-ended responses)
3. Change text responses to lower/proper case to maintain consistency and uniformity
4. Standardize responses (e.g., "can't recall" or "nothing at all" or "N/A" à "nothing")

We first coded for "awareness" of the SBT, from participant responses to the questions above, as well as if they responded "yes" to the question, "*Was the sugary drink tax and/or its campaign one of the reasons you and/or your child changed how much sugary drinks she or he drinks?*" which was also asked in the same survey. Awareness coding was categorized in 3 codes: 1. YES; 2. NO; 3.

UNCLEAR/INCONSISTENT RESPONSE. From the pool of responses that were coded as '1. YES' for awareness, there was a secondary evaluation of "acceptance", with the codes categorized as: 1. ACCEPT/SUPPORT; 2. NEUTRAL; 3. OPPOSE. During the coding process, participants location of residence (Seattle vs. Comparison area) was blinded to ensure there was no bias in the coding process. We conducted two-person independent coding with inter-rater reliability (Cohen's Kappa) for coding of parent awareness, parent acceptance being .33, .54, respectively, with higher absolute percent agreement between coders of 95% and 80%. Differences in SBT awareness and acceptance by residence area were examined by a chi-squared test.

Community presentations and feedback. While we had hoped to host in-person events at locations close to where we had originally met community members for study recruitment (churches, Neighborhood House, etc.) a resurgence of the COVID-19 pandemic limited us to remote events. In November-December 2021, we hosted six events at varying times in order to provide opportunities for participants to attend. All study participants who had responded to 24-month follow up (those who we had recent contact information for) were contacted in advance of the meetings via mailed letter, text, email and phone call. Parents were encouraged to bring their participating child or adolescent and received \$25.00 each for parent and child as thank you for participating. Each Zoom session was two hours long and included a presentation re-introducing the study and the study team, sharing the findings about changes in beverage consumption, and then facilitated discussions to gather participant feedback on findings. All sessions provided simultaneous translation into Somali and Spanish and participants were able to choose breakout sessions based on language preference. We presented parent and child taxable beverage consumption data from baseline, 12-, and 24-month time points. To encourage conversation across the locations, participants from the Seattle and Comparison area were together in the sessions.

Questions to ask in breakout rooms to gather feedback on the data were developed in advance of the sessions by the research team.

Breakout Session #1 (regarding child/teen consumption data):

- Why do you think kids' consumption went down in both Seattle and the Comparison area?
- Why would you expect to see a decrease in sugary beverage consumption?
- Do you think consumption went down in both Seattle and the Comparison area for the same or different reasons?
- Kids' consumption went down a lot at 12 months, but less between 12 and 24 months. Why do you think that is?
- Why do you think it is the same in both groups?
- Do you think this data matches the community's experience?
- What else needs to be said when sharing this data?

Breakout Session #2 (regarding parent consumption data):

- Why do you think parent consumption leveled off in the Comparison area but continued to go down in Seattle?
- How did you experience the Sweetened Beverage Tax?
- Did you make any changes as a result of it?
- Why do you think there was differences in the changes to the amount of consumption between parents and children?
- What was your first reaction?
- What additional questions does this raise?

Facilitators took their own notes in breakout rooms using a common template. Facilitators were careful to note if participants were in Seattle or the Comparison area during the study. Spanish and Somali group leaders did their own translations of notes into English. Notes from all sessions were distilled by a research assistant into a single matrix document to identify themes and common responses. Due to our participant sample, we did not have very many Somali attendees from the Comparison area or any Spanish speakers from Seattle. This is due to our recruiting opportunities at baseline that were very location focused. While we had hoped to host in-person sessions to have better conversations and be able to provide food and childcare, we were limited by the COVID-19 pandemic.