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Retail Soda Purchases Decrease and Water Purchases Increase: 6-Year Results From a Community-Based Beverage Campaign

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Introduction: This study aimed to document the long-term impacts on beverage sales of a 6-year intervention campaign to reduce consumption of sugar-sweetened beverages.

Methods: In 2013, a multicomponent intervention campaign designed to reduce the intake of sugary drinks was launched in Howard County, Maryland. A difference-in-differences regression approach was used to compare data on Howard County supermarket beverage sales (in ounces) from 2013 to 2018 with a set of control supermarkets. Outcome variables were average weekly sales by store of top brands of sugar-sweetened beverages (regular soda, sports drinks, fruit drinks) as well as diet soda and 100% juice. Trends in the sales of water products from 2016 to 2018 were estimated separately using a linear regression model.

Results: In Howard County, the sales of regular soda, fruit drinks, and 100% juice decreased significantly more than predicted each year. These changes correspond to a 29.7% decrease in sales for regular soda, a 7.5% decrease for fruit drinks, and a 33.5% drop for 100% juice between 2012 and 2018 in Howard County stores. There was a significant trend such that the net reduction in regular soda sales in Howard County stores became larger over time. The amount of plain water sold in Howard County increased significantly from 2016 to 2018.

Conclusions: Multicomponent efforts by local government, nonprofit organizations, and other community-based organizations are needed to decrease sugar-sweetened beverage consumption at the population level. Substantial and sustained improvements in retail beverage sales can be achieved through coordinated messaging, community organizing, and targeted advocacy for policy changes.

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INTRODUCTION

According to the 2020–2025 Dietary Guidelines for Americans, added sugars should make up not >10% of daily caloric intake, a limit exceeded by the majority of the U.S. population.[1] Despite decreased consumption in recent years, sugar-sweetened beverages (SSBs) such as regular soda, fruit drinks, and sports drinks continue to be the largest source of added sugars in the American diet.[1–3] The proportion of people consuming at least 1 SSB daily was 26% for adults in 2017[4] and 63% for youth from 2011 to 2014.[5] The harm associated with SSBs is well established: consumption increases the risk of obesity, type 2 diabetes, and cardiovascular disease.[6–8]

To reduce SSB consumption at the population level, government, medical, and public health organizations have promoted an array of policy, systems, and environmental interventions.[9–12] Some states, municipalities, and counties throughout the U.S. have responded by implementing a range of interventions and policies. Strategies include removing SSBs from specific settings (i.e., child care, kindergarten–12th-grade schools, government buildings, hospitals)[13–15]; conducting mass media, educational campaigns[16–18]; and imposing an excise tax on SSBs.[19,20] Encouragingly, a recent systematic review of research evaluating environmental SSB interventions concluded that effective, scalable interventions exist, but additional research is needed to assess the long-term impacts.[21]

Howard County (HC), MD is a community that has sustained ongoing efforts to reduce SSB consumption since 2013.[22,23] HC is located between Washington, DC and Baltimore, MD and has a population of about 300,000 people. Guided by an adapted social–ecologic model and led by the Horizon Foundation, a local nonprofit organization, the team in HC initiated a multicomponent campaign, named Howard County Unsweetened.

Previously, our team conducted the first empirical evaluation of HC Unsweetened using supermarket retail beverage sales from 2012 (baseline) through the first 3 years of the campaign (2013, 2014, and 2015).[23] Using a difference-in-differences (DID) analysis to analyze the first 3 years of the campaign, we found a significantly larger decrease in purchases of regular soda, fruit drinks, and 100% juice in HC stores (n=15) than sales in a set of matched control stores (CSs) (n=17) in a neighboring state. Changes in retail sales of sports drinks and diet soda were not significantly different.

This study builds on the previous analyses by adding 3 more years of data (2016, 2017, and 2018) to test whether the observed decrease in soda, fruit drink, and 100% juice sales was sustained over time and whether significant changes in sports drinks and diet soda sales emerged. Because the campaign promoted drinking water instead of SSBs and the growth of the bottled water market during the campaign,[24] we conducted analyses of bottled water sales data from 2016 to 2018.

METHODS

The Horizon Foundation launched HC Unsweetened in December 2012. The intervention campaign aimed to reduce sugary drink consumption, particularly among youth, and the campaign materials more frequently featured regular soda, sports drinks, and fruit drinks as targets for reduction. Other sweetened beverages were included less often, although they were still featured in communications, including sweet tea, flavored coffee drinks, and water flavored with non-nutritive sweeteners. Finally, in a tool promoted by the campaign (e.g., the Better Beverage Finder), diet soda and 100% juice were listed as better options than SSBs, although neither were promoted nor featured in campaign materials.

This multicomponent campaign is based on the social–ecologic model[22] turned inside out[25] owing to its strong emphasis on the role of policy and systems change. It includes elements designed to influence the beverage purchase and consumption patterns of parents and their children by making multiple targeted changes to the policies and systems environment in which they live and interact (e.g., changes related to how their personal network views SSB consumption, whether or not their faith community serves SSBs during community gatherings, and whether a law makes SSBs less affordable through taxation).

A multicomponent intervention campaign was chosen because evidence is mixed on whether making SSBs less available and accessible in schools alone is enough to reduce sugary drink consumption or reduce a child's overall calories.[26,27] Furthermore, media campaigns in other public health settings (e.g., tobacco-use prevention) have been shown to be at least somewhat effective alone but especially so in combination with other campaign elements.[28,29] Schwartz et al.[23] previously described the HC Unsweetened elements in place during the first phase of this multi-year campaign. Table 1[31–35] shows the new and/or modified campaign elements added during the study period. In addition, many of the initial elements described were still in place during this study period.

Study Sample

Before the campaign began, retail sales data from the 17 supermarkets in HC in 2011–2012 were used to identify a matched control sample of 17 stores in a neighboring state. To identify the CSs, IRI (a commercial company that analyzes scanner data for the consumer-packaged goods industry) used the Matched Market Test, which is a method used to evaluate the impact of local advertising campaigns on sales.[36] The Matched Market Test measures historical sales in a group of stores where the advertising campaign is being conducted (the test market) for the previous 52 weeks and then identifies a sample of stores in another geographic location that, as a group, have comparable historical sales during the same time frame (the control market). This method allows companies to measure the difference between the sales in their test market during the advertising campaign versus their control market. In this study, this method was used to test the HC

Table 1. The 'Howard County Unsweetened' Campaign: New or Modified Components of an Adapted, Inside-Out, Ecologic Model

Campaign	Campaign activities
At the Policy and Environment level[a]	
Let's rethink lunch	The county's only school system, HCPSS serving 57,293 county students (2020), has revised its district wellness policies several times since 2012.[30] The UConn Rudd Center for Food Policy & Health concluded that the revised 2014 wellness policy ranked in the top third[31] of the nation using its WellSAT policy scoring system.[32] The policy removed student-accessible vending machines from elementary and middle schools and established strong nutrition standards from the National Academy of Medicine (formerly the Institute of Medicine) for food and beverages being offered and sold during the school day (including in high school vending machines). During the study period, advocates pressed for improvements to the freshness and quality of the food and drinks being served to children, including an emphasis on serving less sugar and increasing fruit and vegetable consumption (see https://vimeo.com/232078130).
Sugar Free kids Maryland coalition[33]	This coalition of >200 members worked to advance sugary drink policy statewide. Formed soon after the inception of Howard County Unsweetened to spread sugary drink policy work statewide, the coalition worked to advance several state and local policy issues and successfully advocated for 3 local healthy vending laws in nearby counties and for the passage of Baltimore City's Healthy Beverages for Children's Meals law. The Coalition's sugary drink policy campaign work appeared in statewide and local print/online news, on the radio, or on TV 371 times during the study period alone. The Horizon Foundation is a lead partner of the organization.
At the community level[b]	
AAP pediatric obesity collaboratives	Building on a successful initial collaborative serving interested local pediatric practices in 2015, the AAP, Maryland Chapter launched a second, nine-month, targeted quality improvement collaborative in 2017. The purpose of this collaborative was to provide pediatric practice transformation opportunities for the prevention, diagnosis, and treatment of childhood obesity and related diseases. This collaborative targeted 44 high-volume Medicaid providers serving Howard County and Baltimore City who participated in this second cohort. Education resources were provided to collaborative members and practices to help educate patients and their families about the dangers of daily SSB consumption.
Innovations in Childhood Obesity Learning Collaborative[34]	The Horizon Foundation was invited by the Center for Health Care Strategies to lead a state collaborative to reduce childhood obesity in Medicaid enrollees (including local/state government; local pediatricians; and the AAP, Maryland Chapter). Collaborative work started in 2015 and continued through 2017. The purpose of the collaborative was to foster collaboration between the state's Medicaid program and public health organizations and to test innovative ideas to reduce childhood obesity. One of the innovations pursued during the study period examined how to embed dietitians in Head Start using Medicaid as a payment option and how to better collect childhood obesity surveillance data from the electronic medical records of federally qualified health centers and Medicaid-managed care organizations.
Interpersonal connection level[c]	
HoCo unsweetened media campaign	Throughout the course of the campaign, Howard County Unsweetened purchased and aired ads on a variety of mediums, including local cable TV, digital platforms, and social media. Mothers were the main audience for these ads because they are often highly involved in their family's food and drink purchase decisions.[35] During the study period, the campaign created and aired 38 distinct ads (resulting in 21 million impressions) that focused on reducing sports drink and juice drink consumption. Key audiences targeted during this study period included African American/Hispanic parents and generally parents with children aged <18 years. These populations likely viewed more campaign messages than the general population.
Casting calls	Howard County Unsweetened conducted 2 rounds of community casting calls during this study period where community members (both actors and nonactors) could audition to be included in the campaign's TV commercials that aired on social media, on cable TV, and in digital ads. One casting call was centered on recruiting teens for an ad series that targeted beverage industry practices. Since 2012, the campaign has aired 50 distinct ads oftentimes starring local residents.

[a]These campaign activities influence individual behavior by making the default environment in which they live healthier through the enactment of public policies, laws, and budgets.
[b]These campaign activities influence individual behavior by changing the default policies and systems inherent in community organizations. These system changes impact members, clients, and visitors to these organizations.
[c]These campaign activities facilitate individual behavior change through the influence of informal networks of individuals or formal groups organized for other purposes that together work to expand health advocacy movements.
AAP, American Academy of Pediatrics; ad, advertisement; HC, Howard County; HCPSS, Howard County Public School System; HoCo, Howard County; SSB, sugar-sweetened beverages; WellSAT, Wellness School Assessment Tool.

Unsweetened campaign. The matching process identified 17 CSs that as a group had comparable sales with the group of 17 stores in HC and were not exposed to the Howard County Unsweetened campaign. For the first study, 2 retailers in HC would not release their data, so our data included 15 stores in HC and 17 CSs. Owing to store closures in both communities, the 2016 and 2017 data included 13 stores in HC and 15 CSs; the 2018 data included 13 stores in HC and 14 CSs.

Measures

Consistent with our original data analyses from 2012 to 2015, we purchased the same categories of retail sales data from IRI for 2016, 2017, and 2018. The data set included the same top-selling brands of regular soda (n=13), diet soda (n=7), sports drinks (n=2), fruit drinks (n=6), and 100% juice (n=4). Owing to data-use restrictions, the names of the brands cannot be reported.

Reports on national beverage sales trends have suggested that because carbonated soft drink sales have decreased, bottled water sales have increased.[24] To assess whether residents of HC were shifting from SSBs to water products, we purchased sales data for the top-selling water brands in 6 categories: plain water (n=6), carbonated water (n=6), carbonated water with non-nutritive sweeteners (n=3), flavored water (n=1), flavored water with added sugars (n=1), and flavored water with non-nutritive sweeteners (n=2).

Statistical Analyses

For each calendar year (2012−2018), the data set included weekly (n=52) sales data at the universal product code (UPC) level: dollar sales, volume sales in fluid ounces, and unit sales. Of a total of 1,531,470 lines of beverage data at the package-size level per week, there were 0.01% (n=18,790) lines of missing data. The number of lines of missing data did not differ significantly by condition (F=0.22, p=0.80).

To assess beverage sales, we structured the data at the product level: each line in the data set was either 1 UPC or combined UPCs for the same brand and package size. This allowed us to calculate the price per ounce at the package size level and remained consistent with our analysis in the initial paper. A limitation of this method was that there was variability in the number of different package sizes available for each brand across stores and years. We addressed this by also measuring volume sales to reflect the brand level: each line of data included the volume sold each week (calculated by summing across all the different package sizes of a particular brand). This brand–store–week level analysis served as a robustness check because the findings were not influenced by changes in package sizes over time; however, a limitation was that the price per ounce values are averaged across package sizes.

We used DID regression models to estimate the difference in beverage sales trends in the intervention versus in CSs by comparing beverage volume sales in each category over time. The coefficients in the DID analysis represent the estimated intervention effects, that is, the average difference in volume sales in each category between the intervention stores in HC and what they would be had there not been the campaign for each specific year. The models controlled for weekly weather using data from the National Oceanic and Atmospheric Administration because weather may influence beverage sales. The models also included the target product price and the competing product prices. The first DID regression model examined the trend in beverage volume sales by package size, and the second examined the trend in beverage volume sales by brand level. The details of the model specifications are available in the Appendix (available online).

Because this analysis builds on our initial paper examining the campaign during the first 3 years, we also tested whether there was a significant time trend of the DID coefficients (i.e., intervention effects) for each beverage category from 1 year to the next to examine whether the size of the campaign effects we observed after the first year (2013) increased, decreased, or was sustained through 2018.

We graphed the adjusted weekly volume sales for the beverage categories (regular soda, diet soda, sports drinks, fruit drinks, and 100% juice) to visualize the campaign effect from 2012 through 2018. The weekly data were smoothed using a 48-week moving average.

We measured the changes in volume sales of several types of water from 2016 to 2018 in the HC stores and CSs. Owing to a lack of baseline data, DID analyses were not used; instead, trends were examined using a linear regression model. Because the number of available package sizes for each brand varied between conditions and over time, the data were only analyzed at the brand–store–week level (i.e., collapsing across package sizes). The following time-varying control variables were entered: average price per ounce, average price of all the competitors in that beverage category, number of package sizes available, and local weekly mean temperature. The model is presented in the Appendix (available online). Finally, as a robustness check, we aggregated the volume sales of each brand within the same subcategory and performed the same analysis on the subcategory-store-week level.

RESULTS

First, trends in beverage volume sales were examined by package size. The DID estimates from the first model are presented in Table 2. The decreases in volume sales of regular soda, fruit drinks, and 100% juice in the HC stores from baseline to 2013 through 2018 were significantly larger than predicted on the basis of the concurrent changes in the CS, with net reductions by 2018 of 457 ounces, 486 ounces, and 366 ounces, respectively. These changes correspond to a 29.7% decrease in sales of ounces of regular soda, a 7.5% decrease for fruit drinks, and a 33.5% drop for 100% juice between 2012 and 2018 in HC stores. By comparison, the CS data showed a decrease of 1.6% for regular soda, an increase of 16.2% for fruit drinks, and a decrease of 25% for 100% juice during the same time frame. A graph of adjusted weekly sales of regular soda is depicted in Figure 1.

The sales patterns for diet soda and sports drinks were more variable (Table 2 and Figure 2). The sales of sports drinks dropped in both HC and CS over the 6 years and were significantly lower in HC in 2013 and 2016. However, by 2018, sports drinks sales in HC were no longer

Table 2. Estimated DID Volume Sales of Beverages at Package Size Level Compared With 2012 Baseline

Beverage	Net DID (95% CI) in volume sales					
	2013	2014	2015	2016	2017	2018
Regular soda	**−260.6**** (−350.1, −171.1)	**−385.3**** (−474.2, −296.4)	**−388.2**** (−477.4, −299.0)	**−409.7**** (−500, −319.4)	**−406.1**** (−496.4, −315.8)	**−457.0**** (−548, −366.1)
Diet soda	−97.4 (−192.6, −2.1)	**−138.9*** (−233.6, −44.2)	−76.8 (−172.5, 19.0)	−74.8 (−173.3, 23.7)	−58.2 (−157.4, 41.0)	**−245.8**** (−343.7, −147.9)
Sports drinks	**−119.3**** (−200, 0.0)	−219.8 (−453, 13.5)	−224.8 (−457.4, 7.9)	**−325.1*** (−562.2, −88.0)	−190.8 (−429.3, 47.6)	20.6 (−218.2, 259.5)
Fruit drinks	**−567.6**** (−684.4, −450.7)	**−192.5*** (−307.5, −77.6)	**−310.7**** (−430.6, −190.8)	**−398.9**** (−524.6, −273.1)	−382.0** (−509.9, −254.2)	**−486.0**** (−615.4, −356.7)
100% juice	**−392.4**** (−584.9, −199.9)	**−583.6**** (−776.7, −390.5)	**−499.4**** (−692.8, −306.1)	**−340.0*** (−536.6, −143.4)	**−275.5*** (−472.1, −78.8)	**−365.7**** (−562.2, −169.1)

Note: Boldface indicates statistical significance (* $p<0.05$, ** $p<0.01$).
These coefficients represent the estimated average difference in volume sales in each category between the actual sales in the intervention stores and the predicted sales (i.e., with no intervention) based on the control store sales for each year.
DID, difference-in-differences.

significantly lower than expected because the CS sales had also decreased.

When trends were examined at the brand level as a robustness check, the overall sales patterns were the same as those of the package-level analyses. The DID coefficients for each year were significant for regular soda, diet soda, fruit drinks, and 100% juice (Table 3).

To examine whether the size of the campaign effect increased, decreased, or was sustained at the same level over time, we conducted a linear trend analysis to assess the average yearly change in the campaign effect after 2013 in each beverage category (Appendix Table 1, available online). There was a negative and significant time trend effect for the DID coefficient of regular soda sales (−30.65, $p<0.001$); the net reduction in regular soda sales in HC stores became significantly larger over time (Figure 1).

The moving means of the adjusted weekly volume sales for diet soda, sports drinks, fruit drinks, and 100% juice are graphed in Appendix Figure 1 (available online) and illustrate the pattern of changes. As noted earlier, the DID analyses (Table 2) indicate that by 2018, sales of diet soda, fruit drinks, and 100% juice in HC were significantly lower than would have been predicted on the basis of the CS sales. For diet soda and fruit drinks, the change was sustained over time (with an average yearly change of −13.92 and −3.91, respectively) (Appendix Table 1, available online) but did not significantly increase each year. For 100% juice, the DID analysis shows a significant decrease each year when compared with baseline (Table 2); however, the positive coefficient of 34.14 in Appendix Table 1 (available online) reflects the fact that the average size of the change grew smaller because the rate of the decrease in sales in the CS accelerated. Finally, as noted earlier, the average annual change in the sales of sports drinks in HC diminished over time because of the accelerated decline in sales in the CS.

Lastly, trends in sales of water products between 2016 and 2018 were examined. The linear regression model assessing water sales from 2016 to 2018 found that the amount of plain water sold in HC for each brand in each store significantly increased by 81.4 ounces per week ($p<0.001$), whereas sales significantly decreased by 58.1 ounces per week in the CSs (Table 4 and Appendix Figure 1, available online). For carbonated water, sales increased in both sets of stores, but the increase was significantly greater in HC than in CS. A sensitivity store-level analysis showed similar results: a difference in time trend of 177.3 ounces ($p<0.001$) for plain water and 49.4 oz ($p<0.001$) for carbonated water for HC compared with that for CS (Table 5). For all the other water

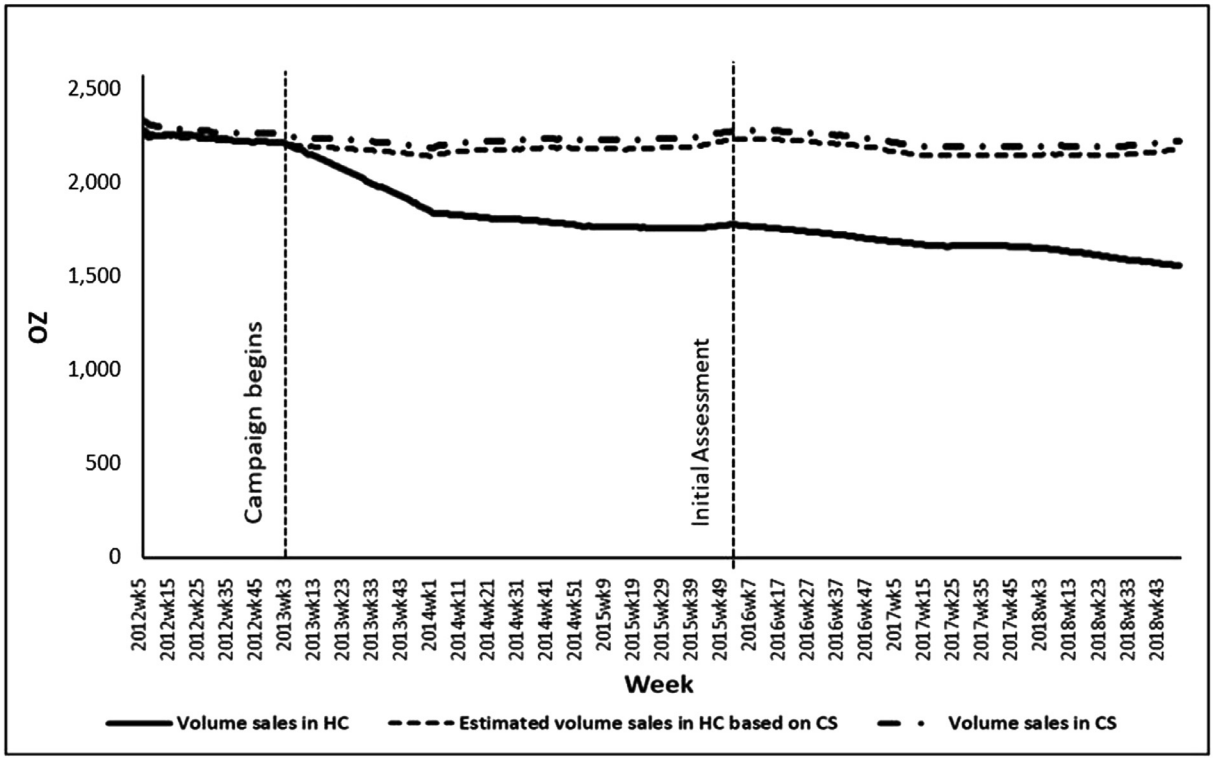

Figure 1. Moving mean of adjusted weekly volume sales of regular soda.

CS, control store; HC, Howard County; OZ, ounce; wk, week.

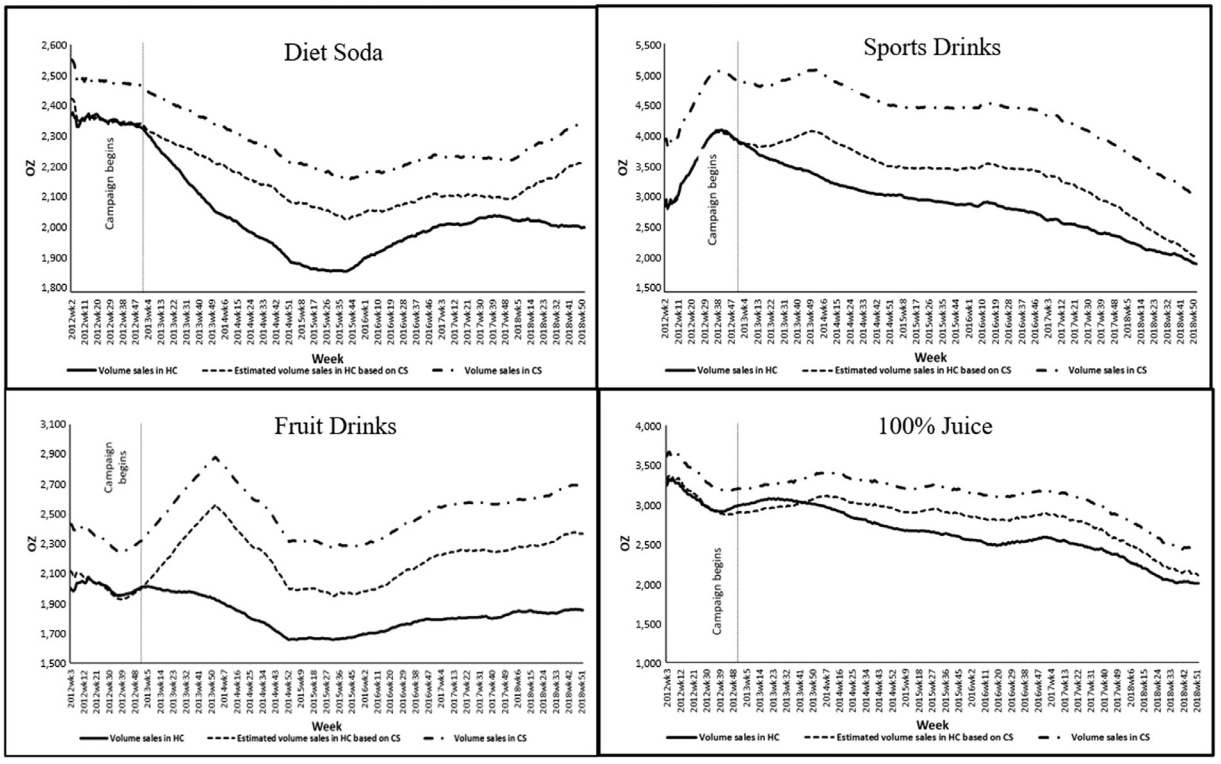

Figure 2. Moving mean of adjusted weekly volume sales by type of drink.

CS, control store; HC, Howard County; OZ, ounce; wk, week.

Table 3. Estimated DID Volume Sales of Beverages at the Brand Level From 2012 to 2018

Beverage	Net DID (95% CI) in Volume Sales, fl. oz											
	2012−2013		2012−2014		2012−2015		2012−2016		2012−2017		2012−2018	
Regular soda	−1,224***	(−1,549.1, −898.2)	−1,643***	(−1,969.6, −1,315.6)	−2,301***	(−2,631.5, −1,970.3)	−2,265***	(−2,606.1, −1,923.9)	−1,820***	(−2,164.6, −1,474.7)	−2,099***	(−2,446.6, −1,750.8)
Diet soda	−1,054***	(−1,318.0, −789.3)	−962.8**	(−1,228.2, −697.3)	−1,510***	(−1,778.9, −1,242.0)	−1,379***	(−1,656.3, −1,102.2)	−965.3***	(−1,244.7, −686.0)	−1,631***	(−1,912.2, −1,350.6)
Sport drink	−1,592***	(−2,127.4, −1,057.5)	−1,114***	(−1,650.3, −577.9)	−1,476***	(−2,019.5, −932.0)	−1,368***	(−1,927.8, −808.9)	−421.2	(−987.3, 144.9)	947.2**	(379.4, 1,515.0)
Fruit drink	−1,693**	(−1,849.6, −1,537.1)	−1,220**	(−1,376.7, −1,062.9)	−840.9***	(−999.3, −682.4)	−850.1***	(−1,013.8, −686.4)	−693.6**	(−859.2, −528.0)	−845.2***	(−1,012.4, −678.0)
100% juice	−743.0**	(−1,047.6, −438.4)	−1,145**	(−1,451.3, −839.5)	−1,945***	(−2,254.5, −1,635.1)	−1,394**	(−1,713.6, −1,074.8)	−1,550***	(−1,877.1, −1,223.7)	−1,338***	(−1,668.8, −1,006.9)

Note: Boldface indicates statistical significance (**$p<0.01$, ***$p<0.001$).
DID, difference-in-differences.

products, sales increased in both sets of stores, with greater increases in the CS than in HC.

DISCUSSION

In this analysis of long-term results of the Howard County Unsweetened campaign, the significantly lower sales of regular soda, fruit drinks, and 100% juice in HC compared with that for the CSs observed in our initial publication between 2012 and 2015 were still evident in 2018. Furthermore, the campaign appears to have led to progressively greater reductions in the sales of regular soda over 6 years.

Although we observed significantly lower diet soda sales between 2012 and 2018 and a sustained campaign impacts, the pattern of sales suggests considerable variability in diet soda purchasing during this time frame. The public health community has not reached a clear consensus on whether to recommend diet soda as a healthier alternative to SSBs. The American Heart Association and American College of Cardiology released a consensus statement with the conclusion that there is not yet sufficient evidence to warrant placing diet soda in the same category as SSBs.[37] However, more recent research[38] found that diet soda was associated with all-cause mortality, raising the question of whether public health messaging should explicitly warn against diet sodas.

Sports drinks have proven to be the most difficult SSB category to influence in HC. Nationally, consumption of sports drinks in the U.S. remains very high at 5.11 gallons per capita in 2017.[39] The popularity of sports drinks is attributed to their successful marketing as a lower sugar alternative to soda that also contains electrolytes.[38] Although the sales of sports drinks decreased overall in HC during the study period, the difference between HC and CS diminished over time, suggesting that the intervention did not have a significant effect. It will be important to continue efforts to decrease sports drink consumption because they are associated with the same negative consequences as those of other SSBs.[40,41]

There were significant increases in the sales of plain and carbonated water across both communities, and the increase in HC was significantly greater than in the CS. Although this difference cannot be attributed to the intervention because we do not have baseline data, it suggests that HC residents may be substituting water for SSBs. Nationally, water sales increased by 40% between 2017 and 2018 alone,[42] highlighting that this shift to water is likely to continue. Of concern, there was also an increase in sales

Table 4. Time Trend in Brand-Level Water Products Volume Sales Change Between 2016 and 2018

Beverage	Time trend,[a] Mean (SE) (oz)		Difference in time trend between HC and CS[b] Mean (SE) (oz)
	HC	CSs	
Plain water	**81.4 (65.1, 97.8)**	**−58.1 (−75.1, 41.2)**	**99.2 (76.4, 121.9)**
Carbonated water	**27.0 (23.8, 30.1)**	**12.6 (11.1, 14.2)**	**13.3 (10.2, 16.4)**
Carbonated water with non-nutritive sweetener	**6.6 (5.2, 8.0)**	**9.6 (8.1, 11.0)**	**−2.4 (−4.1, 0.70)**
Flavored water	**3.0 (1.7, 4.3)**	**4.7 (4.1, 5.4)**	**−2.7 (−4.2, 1.2)**
Flavored water with non-nutritive sweetener	**8.2 (7.3, 9.1)**	**12.9 (12.0, 13.7)**	**−4.3 (−5.4, 3.1)**
Flavored water with added sugar	**1.0 (0.7, 1.4)**	**3.6 (3.1, 4.1)**	**−2.1 (−2.6, 1.5)**

Note: Boldface indicates statistical significance ($p<0.001$).
[a]These time trend means were estimated using separate models for HC and CS.
[b]The difference in time trends between HC and CS was estimated by an interaction term in the combined model with multiple covariates. Therefore, this value does not equal the simple difference between the HC and CS models. See more details in the Appendix (available online).
CS, control store; HC, Howard County.

Table 5. Store-Level Trend in Water Product Sales

Beverage	Time trend,[a] Mean (SE) (oz)		Difference in time trend between HC and CS[b] Mean (SE) (oz)
	HC	CSs	
Plain water	**224.2 (131.4, 316.9)*** **	29.6 (−42.4, 101.5)	**177.3 (62.4, 292.3)** **
Carbonated water	**157.8 (140.2, 175.4)*** **	**110.9 (103.8, 118.0)*** **	**49.4 (32.3, 66.5)*** **
Carbonated water with artificial sweetener	**22.0 (19.1, 24.9)*** **	**25.2 (22.5, 27.8)*** **	−1.6 (−5.1, 1.9)
Flavored water	**2.9 (1.5, 4.2)*** **	**4.5 (3.9, 5.1)*** **	**−2.2 (−3.7, −0.7)** **
Flavored water with artificial sweetener	**9.8 (8.7, 10.9)*** **	**14.9 (13.9, 15.8)*** **	**−4.6 (−6.0, −3.2)*** **
Flavored water with added sugar	**2.2 (1.4, 3.0)*** **	**8.2 (7.1, 9.2)*** **	**−4.8 (−6.2, −3.6)*** **

Note: Boldface indicates statistical significance (** $p<0.01$, *** $p<0.001$).
[a]These time trend means were estimated using separate models for HC and CS.
[b]The difference in time trends between HC and CS was estimated by an interaction term in the combined model with multiple covariates. Therefore, this value does not equal the simple difference between the HC and CS models. See more details in the Appendix (available online).
CS, control store; HC, Howard County.

of flavored water with added sugar or non-nutritive sweeteners observed in both sets of stores. It will be important to attend to the promotion of these products and inform people that they carry the same health risks as other SSBs.

In the years since our initial paper was published, several other studies have used IRI data to assess SSB sales, and a variety of units of analysis and approaches are used. These include using package size, per capita attribution of volume sales (liters/person/year), ounces per transaction, ounces per UPC, and store-level sales.[20,23,43–45] The variability in approaches limits the ability to compare across studies. Future work developing a standardized approach for analyzing this type of data is needed.

Limitations

This study also has limitations. First, we only included sales data from supermarkets. Although previous research indicates that supermarkets are the primary source of most SSBs sales,[46] SSBs are also purchased in other types of stores (e.g., convenience, mass merchandizers) and restaurants. Second, although the sample of stores in the control communities was carefully matched for SSB sales in HC in 2012, the supermarket landscape is not static. Our analyses used the average weekly values for each product in each store, which should mitigate the effect of a loss of a small number of stores; however, it is possible that our findings were influenced by these changes. In addition, the demographic profiles of the 2 communities where the stores are located are different,

as noted in our original paper,[23] and data on the characteristics of the people within each community who are purchasing SSBs are unavailable. In addition, because the campaign was designed to specifically reduce the consumption of sugary drinks, we only purchased IRI beverage sales data. Theoretically, a decrease in sugary drink purchases may be accompanied by an increase in purchases of foods with added sugar (e.g., candy). This question was evaluated by a recent study by Powell and colleagues.[47] They found that the sweetened beverage tax in Seattle was associated with a 23% drop in grams of sugars sold from taxed beverages and a 4% increase in grams of sugar sold from other sources, resulting in a net 19% reduction in grams of sugar sold 2 years after tax. Future research in HC could assess whether a small compensatory increase occurred here as well. Finally, the disparities in SSB consumption by race and ethnicity are well documented,[48] and it is possible that even if SSB consumption is decreasing overall, it may not be decreasing at the same rate among those at highest risk of negative health consequences.

CONCLUSIONS

HC Unsweetened shows how local government, nonprofit organizations, and other community-based organizations can work together to create sustained environmental and policy changes to limit SSB consumption. These findings provide evidence that a community-wide campaign targeting SSBs can lead to substantial improvements in retail beverage sales that are sustained over 6 years.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.focus.2022.100008.

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