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Title: Trends in beverage prices following the introduction of a tax on sugar-sweetened beverages in Barbados

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Abstract: A 10% excise tax on sugar sweetened beverages (SSBs) was implemented in Barbados in September 2015. A national evaluation has been established to assess the impact of the tax. We present a descriptive analysis of initial price changes following implementation of the SSB tax using price data provided by a major supermarket chain in Barbados over the period 2014-2016. We summarize trends in price change before and after the tax using year-on-year mean price per liter change between SSBs and non-SSBs. We find that prior to the tax, year-on-year price growth of SSBs and non-SSBs was very similar (approximately 1%). During the quarter in which the tax was implemented, the trends diverged, with SSB prices growing by almost 3% while prices of non-SSBs decreased slightly. The growth of SSB prices outpaced non-SSBs prices in each quarter thereafter, reaching 5.9% growth compared to <1% for non-SSBs. Future analyses will assess the trends in prices of SSBs and non-SSBs over a longer period and will integrate price data from additional sources to assess heterogeneity of post-tax price changes. A continued examination of the impact of the SSB tax in Barbados will expand the evidence base available to policymakers worldwide in considering SSB taxes as a lever for reducing the consumption of added sugars at the population level.

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The Editor  
Preventive Medicine Editorial Office  
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July 6, 2017

Dear Editor:

Please find our re-submission of a letter to the editor titled "Trends in beverage prices following the introduction of a tax on sugar-sweetened beverages in Barbados" for your consideration as part of the supplement guest-edited by Frank J Chaloupka and Deliana Kostova, titled "Perspectives on noncommunicable disease risk factor prevention."

Thank you for clarifying the additional word limits for this submission. The revised abstract is 215 words and the manuscript is 913 words, with one figure and 11 references.

Based on reviewer feedback, we made several clarifications and additions to address reviewer comments. As we mentioned previously, this letter represents the first evaluation of a sugar-sweetened beverage (SSB) tax policy in the Caribbean, and focuses on the initial price changes in beverages following implementation of the tax. We believe that although it is short, it communicates the potential implications of the price data in an improved and clearer manner.

We do not have any conflicts of interest to report, nor has this work been published previously. All authors have actively participated in the design and writing of the paper, and have approved the paper in its current form. Institutional review was not required for the work presented here, as this paper did not involve data collection from human subjects or make use of any data traceable to individual human subjects. Please let me know if there is any additional information that I can provide.

Thank you again for considering this submission.

Sincerely,  
Miriam Alvarado  
PhD Candidate  
University of Cambridge

REVIEWERS' COMMENTS FOLLOW:

Reviewer #2: The authors converted the manuscript into a letter. In my opinion, this letter seems a reasonable option given the importance to show, at least from unadjusted numbers, how prices changed after the tax was implemented. I have some comments/ clarifications and recommendations.

Thank you for reviewing this a second time, and we are glad you agree that this represents a reasonable option/format.

The graph shows annual changes in prices compared with the same quarter to at least adjust for seasonality. Are prices deflated?

We have not deflated prices in this descriptive summary, although we will in future analyses. We have clarified this in the text: "For this descriptive analysis, unadjusted prices were used. As inflation would likely lead to similar proportional price changes among SSBs and non-SSBs, using unadjusted prices still allows a comparison of price change trends following the implementation of the tax."

What is the grey bar in the graph?

The grey bar was intended to represent the period between announcement of the tax and implementation, during the third quarter when the tax was implemented. However, we agree that the grey bar is a bit confusing and have replaced it with two lines to indicate when the tax was announced and subsequently implemented. We have included the following text: "The two vertical lines in the Figure correspond to June 2015, when the tax was first announced and to September 2015, when the tax was first implemented. It is possible that manufacturers or retailers may have increased prices following the announcement of the tax, in anticipation of the actual implementation date."

A one sentence explaining the negative change in non-SSB prices would be ideal. Could this be a strategy from the industry?

We agree that it would be helpful to explain the dip in non-SSB prices. It may be an industry response, but it is not clear to what extent this was a strategic response, and by whom, and to what extent it may be explained as a standard fluctuation in prices. We have added the following to address this "It is possible that the slight dip in non-SSB prices may have been part of an industry response to the introduction of the SSB tax, or may reflect other unknown factors. Bottled water and other diet beverages are produced/imported by some of the same manufacturers and distributors that supply SSBs. Future analyses will assess the trends in prices of SSBs and non-SSBs over a longer period and by manufacturer/distributor to further explore these diverging trends."

Is bottled water included in the non-SSB category and if so, is it produced by the beverage industry? A brief description of the beverages included in the non-SSB category is recommended.

We agree that it would be helpful to clarify the SSB and non-SSB categories. We have included the following text "We classified sodas, sugar-sweetened juices, and sugar-sweetened sports and energy drinks as SSBs, and no-added-sugar juices, sugar-free (diet) sodas/energy drinks/sports drinks, and bottled waters as non-SSBs."

Bottled water is included in the non-SSB category, and it is produced by some of the same bottling/manufacturing companies that produce high-selling SSBs. Some bottled water is also imported. We have added "Bottled water and other diet beverages are produced/imported by some of the same manufacturers and distributors that supply SSBs"

I also recommend that the authors emphasize in the letter that this is an unadjusted/descriptive analysis; that the data comes from a chain of supermarkets that may not be representative of all stores in the country and that further studies should assess the heterogeneity of the pass-through prices.

Thank you for highlighting this, and yes, we agree that it is important to highlight that these are unadjusted data and represent a preliminary, solely descriptive analysis. We have included the following “This is a preliminary descriptive analysis using readily available price data following the Barbados SSB tax.... In addition, these price data represent prices in one major retail chain, and may not be representative of price changes across all stores. Future work will aim to integrate price data from additional sources to assess heterogeneity of post-tax price changes.”

#### EDITORIAL OFFICE'S ADDITIONAL REVISION INSTRUCTIONS:

You may use up to 2000 words for your revised manuscript (main text) (and a maximum of 250 words for the abstract), including the additional text required to address the points raised in the critiques. We ask you to include word counts for the abstract and for the main text on the cover page. Please take into account also the editorial instructions in the body of this email.

Thank you for clarifying these word limits. We have added an abstract of 215 words, and summarized the word count for the abstract and main text (913 words) in our revised cover page.

### Highlights

A 10% excise tax was introduced on sugar-sweetened beverages (SSBs) in Barbados  
SSBs and non-SSBs showed similar year-on-year price growth trends prior to the tax  
Post-tax, the growth in SSB prices reached 5.9% while staying below 1.0% for non-SSBs

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4 **Trends in beverage prices following the introduction of a tax on sugar-sweetened beverages in**  
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6 **Barbados**

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10 Trevor Hassell, MD<sup>4</sup>, T Alafia Samuels, MBBS<sup>1</sup>, Jean Adams, PhD<sup>5</sup>, Nigel Unwin, DM<sup>1,5</sup> on behalf of  
11 the Barbados SSB Tax Evaluation Group  
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17 **Keywords:** Nutrition policy, obesity, primary prevention, economics, diet, diabetes mellitus  
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4 Abstract  
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6 A 10% excise tax on sugar sweetened beverages (SSBs) was implemented in Barbados in September  
7 2015. A national evaluation has been established to assess the impact of the tax. We present a descriptive  
8 analysis of initial price changes following implementation of the SSB tax using price data provided by a  
9 major supermarket chain in Barbados over the period 2014-2016. We summarize trends in price change  
10 before and after the tax using year-on-year mean price per liter change between SSBs and non-SSBs. We  
11 find that prior to the tax, year-on-year price growth of SSBs and non-SSBs was very similar  
12 (approximately 1%). During the quarter in which the tax was implemented, the trends diverged, with SSB  
13 prices growing by almost 3% while prices of non-SSBs decreased slightly. The growth of SSB prices  
14 outpaced non-SSBs prices in each quarter thereafter, reaching 5.9% growth compared to <1% for non-  
15 SSBs. Future analyses will assess the trends in prices of SSBs and non-SSBs over a longer period and  
16 will integrate price data from additional sources to assess heterogeneity of post-tax price changes. A  
17 continued examination of the impact of the SSB tax in Barbados will expand the evidence base available  
18 to policymakers worldwide in considering SSB taxes as a lever for reducing the consumption of added  
19 sugars at the population level.  
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6 Caribbean populations suffer from the highest burden of non-communicable diseases (NCDs) in the  
7 Americas (*Health in the Americas 2012 Edition: Regional Outlook*, 2012). Barbados, an island in the  
8 Eastern Caribbean, faces a serious problem with overweight, obesity and related diseases. In 2012, the  
9 adult rates of overweight and obesity were 74.2% and 43.4%, respectively, for women, and 66.2% and  
10 23.4%, respectively, for men (Howitt et al., 2015).  
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15 In June 2015, the Government of Barbados announced the introduction of a 10% ad valorem tax on sugar-  
16 sweetened beverages (SSBs). The tax is applied to sodas, sugar-sweetened juices, and sugar-sweetened  
17 sports and energy drinks, but not 100% juices, sugar-free (diet) sodas, or sugar-free flavored waters  
18 (Healthy Caribbean Coalition, 2016). The tax was implemented in September 2015, making Barbados the  
19 first country in the Caribbean with this measure (Healthy Caribbean Coalition, 2016).  
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24 There is considerable evidence linking increased consumption of SSBs with weight gain in adults and  
25 children, and increased incidence of type 2 diabetes independent of adiposity (Imamura et al., 2015;  
26 Malik et al., 2013). Reduced consumption of beverages with added sugar can have population-level health  
27 benefits (Brownell et al., 2009; Mytton et al., 2014; World Health Organization, 2016). A tax on SSBs  
28 can lead to an increase in the prices of SSBs relative to other beverages, creating an incentive for reducing  
29 the demand for SSBs. Prices of SSBs have been shown to increase relative to prices of non-SSBs  
30 following implementation of SSB taxes in Mexico and Berkeley, California (Cawley and Frisvold, 2017;  
31 Colchero et al., 2015; Grogger, 2015). An ongoing evaluation of the effect of the 2015 SSB tax on  
32 beverage prices and sales in Barbados is presently being conducted at the University of West Indies, on  
33 behalf of the Barbados SSB Tax Evaluation Steering Committee. This letter highlights the motivation for  
34 further analytic assessment of SSB tax effects in Barbados by comparing the pace of growth in SSB and  
35 non-SSB prices leading up to and immediately following the tax implementation.  
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45 We used retail sales data on 224 unique beverages from a large supermarket chain in Barbados from the  
46 last quarter of 2013 through the first quarter of 2016. Prices per liter were calculated by dividing total  
47 beverage sales in Barbados dollars by sales volume. We classified sodas, sugar-sweetened juices, and  
48 sugar-sweetened sports and energy drinks as SSBs, and no-added-sugar juices, sugar-free (diet)  
49 sodas/energy drinks/sports drinks, and bottled waters as non-SSBs. We then calculated average quarterly  
50 prices and estimated the year-over-year percentage change in quarterly prices for each category. Prices in  
51 each quarter were assessed relative to the same quarter of the previous year to account for within-year  
52 seasonality. The resulting price growth estimates were compared across categories (Figure). In the three  
53 quarters prior to the introduction of the tax, SSBs and non-SSBs experienced very similar year-over-year  
54 price growth of approximately 1% for both beverage categories, and had parallel patterns of fluctuation.  
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4 During the third quarter of 2015, at the end of which the SSB tax took effect, the trends diverged. At that  
5 time, the growth in SSB prices approached 3% while the growth in non-SSB prices decreased; thereafter,  
6 the change in SSB prices outpaced that of non-SSBs. In the two quarters after the tax took effect, the  
7 growth in average SSB prices compared to the previous year reached 5.9% while staying mostly flat,  
8 between 0 and 1%, for non-SSBs. The two vertical lines in the Figure correspond to June 2015, when the  
9 tax was first announced and to September 2015, when the tax was first implemented. It is possible that  
10 manufacturers or retailers may have increased prices following the announcement of the tax, in  
11 anticipation of the actual implementation date.  
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18 This is a preliminary descriptive analysis using readily available price data following the Barbados SSB  
19 tax. For this descriptive analysis, unadjusted prices were used. As inflation would likely lead to similar  
20 proportional price changes among SSBs and non-SSBs, using unadjusted prices still allows a comparison  
21 of price change trends following the implementation of the tax. Additional data are being collected to  
22 extend the post-tax observation period to 18 months, expanding the analysis of the tax effect on beverage  
23 prices and sales volume while accounting for variations in product size and type and adjusting for  
24 inflation.  
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31 It is possible that the slight dip in non-SSB prices may have been part of an industry response to the  
32 introduction of the SSB tax, or may reflect other unknown factors. Bottled water and other diet  
33 beverages are produced/imported by some of the same manufacturers and distributors that supply SSBs.  
34 Future analyses will assess the trends in prices of SSBs and non-SSBs over a longer period and by  
35 manufacturer/distributor to further explore these diverging trends. In addition, these price data represent  
36 prices in one major retail chain, and may not be representative of price changes across all stores. Future  
37 work will aim to integrate price data from additional sources to assess heterogeneity of post-tax price  
38 changes.  
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47 In summary, we have shown a divergence in the growth trends of SSB prices relative to non-SSB prices  
48 following the introduction of the tax. This evidence is foundational to the forthcoming evaluation of the  
49 tax as a factor in raising SSB prices in Barbados. Presently, the number of countries that have  
50 implemented SSB taxes is limited. An examination of the impact of SSB taxes in Barbados will expand  
51 the evidence base available to policymakers worldwide in considering SSB taxes as a lever for reducing  
52 the consumption of added sugars at the population level.  
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7 NCD Commission of Barbados and Healthy Caribbean Coalition); Miriam Alvarado (CEDAR, University  
8 of Cambridge); Kenneth George (Ministry of Health), Ian Hambleton (UWI); Maisha Hutton (Healthy  
9 Caribbean Coalition); Winston Moore (UWI); Madhuvanti Murphy (UWI); Alafia Samuels (UWI);  
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11 of Finance).  
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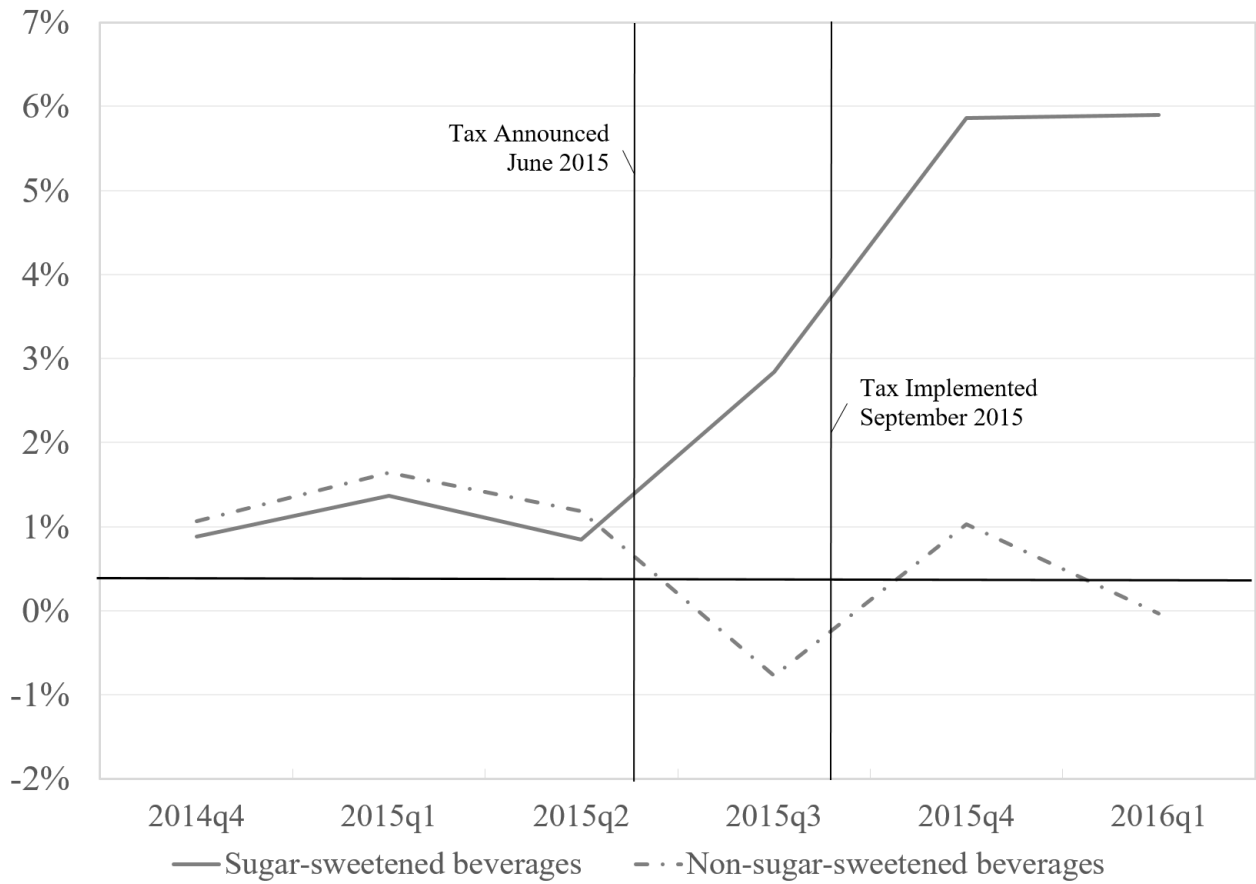
28 **Disclaimer**  
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30 The findings and conclusions in this report are those of the authors and do not necessarily represent the  
31 official position of the US Centers for Disease Control and Prevention.  
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33 **Conflict of Interest**  
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35 The authors declare there is no conflict of interest.  
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Figure: Year-over-year percent change in the average quarterly price per liter of sugar-sweetened and non-sugar-sweetened beverages, Barbados, 2014-2016<sup>1</sup>



<sup>1</sup> The first line corresponds to June 2015 when the tax was first announced, and the second line corresponds to September 2015, when the tax was first implemented

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4 **Abstract**  
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6 A 10% excise tax on sugar sweetened beverages (SSBs) was implemented in Barbados in September  
7 2015. A national evaluation has been established to assess the impact of the tax. We present a descriptive  
8 analysis of initial price changes following implementation of the SSB tax using price data provided by a  
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16 will integrate price data from additional sources to assess heterogeneity of post-tax price changes. A  
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19 first country in the Caribbean with this measure (Healthy Caribbean Coalition, 2016).  
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24 **There is considerable evidence linking increased consumption of SSBs with weight gain in adults and**  
25 **children, and increased incidence of type 2 diabetes independent of adiposity (Imamura et al., 2015;**  
26 **Malik et al., 2013).** Reduced consumption of beverages with added sugar can have population-level health  
27 benefits (Brownell et al., 2009; Mytton et al., 2014; World Health Organization, 2016). A tax on SSBs  
28 can lead to an increase in the prices of SSBs relative to other beverages, creating an incentive for reducing  
29 the demand for SSBs. Prices of SSBs have been shown to increase relative to prices of non-SSBs  
30 following implementation of SSB taxes in Mexico and Berkeley, California (Cawley and Frisvold, 2017;  
31 Colchero et al., 2015; Grogger, 2015). An ongoing evaluation of the effect of the 2015 SSB tax on  
32 beverage prices and sales in Barbados is presently being conducted at the University of West Indies, on  
33 behalf of the Barbados SSB Tax Evaluation Steering Committee. This letter highlights the motivation for  
34 further analytic assessment of SSB tax effects in Barbados by comparing the pace of growth in SSB and  
35 non-SSB prices leading up to and immediately following the tax implementation.  
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45 We used retail sales data on 224 unique beverages from a large supermarket chain in Barbados from the  
46 last quarter of 2013 through the first quarter of 2016. Prices per liter were calculated by dividing total  
47 beverage sales in Barbados dollars by sales volume. **We classified sodas, sugar-sweetened juices, and**  
48 **sugar-sweetened sports and energy drinks as SSBs, and no-added-sugar juices, sugar-free (diet)**  
49 **sodas/energy drinks/sports drinks, and bottled waters as non-SSBs. We then** calculated average quarterly  
50 prices and estimated the year-over-year percentage change in quarterly prices for each category. Prices in  
51 each quarter were assessed relative to the same quarter of the previous year to account for within-year  
52 seasonality. The resulting price growth estimates were compared across categories (Figure). In the three  
53 quarters prior to the introduction of the tax, SSBs and non-SSBs experienced very similar year-over-year  
54 price growth of approximately 1% for both beverage categories, and had parallel patterns of fluctuation.  
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4 During the third quarter of 2015, at the end of which the SSB tax took effect, the trends diverged. At that  
5 time, the growth in SSB prices approached 3% while the growth in non-SSB prices decreased; thereafter,  
6 the change in SSB prices outpaced that of non-SSBs. In the two quarters after the tax took effect, the  
7 growth in average SSB prices compared to the previous year reached 5.9% while staying mostly flat,  
8 between 0 and 1%, for non-SSBs. The two vertical lines in the Figure correspond to June 2015, when the  
9 tax was first announced and to September 2015, when the tax was first implemented. It is possible that  
10 manufacturers or retailers may have increased prices following the announcement of the tax, in  
11 anticipation of the actual implementation date.  
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18 This is a preliminary descriptive analysis using readily available price data following the Barbados SSB  
19 tax. For this descriptive analysis, unadjusted prices were used. As inflation would likely lead to similar  
20 proportional price changes among SSBs and non-SSBs, using unadjusted prices still allows a comparison  
21 of price change trends following the implementation of the tax. Additional data are being collected to  
22 extend the post-tax observation period to 18 months, expanding the analysis of the tax effect on beverage  
23 prices and sales volume while accounting for variations in product size and type and adjusting for  
24 inflation.  
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31 It is possible that the slight dip in non-SSB prices may have been part of an industry response to the  
32 introduction of the SSB tax, or may reflect other unknown factors. Bottled water and other diet  
33 beverages are produced/imported by some of the same manufacturers and distributors that supply SSBs.  
34 Future analyses will assess the trends in prices of SSBs and non-SSBs over a longer period and by  
35 manufacturer/distributor to further explore these diverging trends. In addition, these price data represent  
36 prices in one major retail chain, and may not be representative of price changes across all stores. Future  
37 work will aim to integrate price data from additional sources to assess heterogeneity of post-tax price  
38 changes.  
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46 In summary, we have shown a divergence in the growth trends of SSB prices relative to non-SSB prices  
47 following the introduction of the tax. This evidence is foundational to the forthcoming evaluation of the  
48 tax as a factor in raising SSB prices in Barbados. Presently, the number of countries that have  
49 implemented SSB taxes is limited. An examination of the impact of SSB taxes in Barbados will expand  
50 the evidence base available to policymakers worldwide in considering SSB taxes as a lever for reducing  
51 the consumption of added sugars at the population level.  
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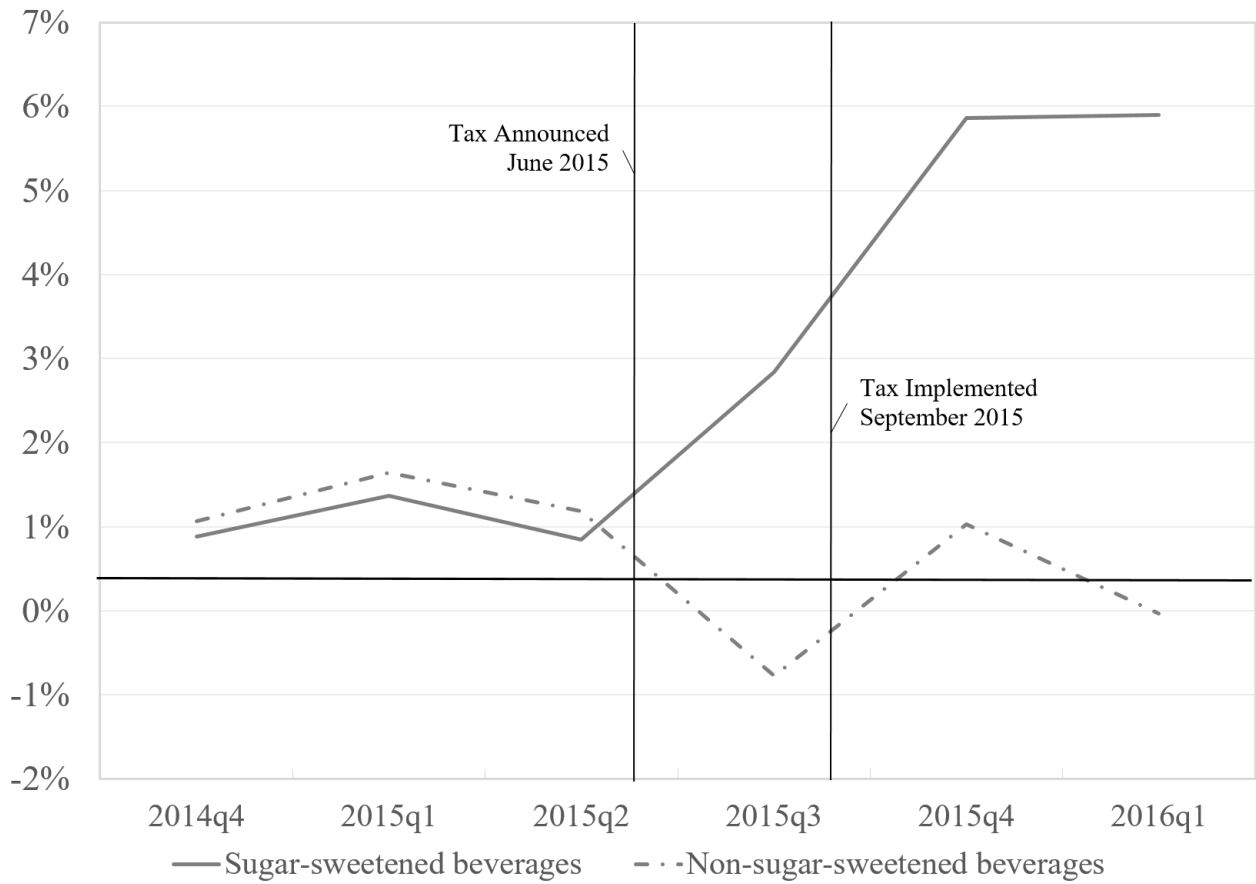
39 **Disclaimer**  
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41 The findings and conclusions in this report are those of the authors and do not necessarily represent the  
42 official position of the US Centers for Disease Control and Prevention.  
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45 **Conflict of Interest**  
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47 The authors declare there is no conflict of interest.  
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Figure: Year-over-year percent change in the average quarterly price per liter of sugar-sweetened and non-sugar-sweetened beverages, Barbados, 2014-2016<sup>1</sup>



<sup>1</sup> The first line corresponds to June 2015 when the tax was first announced, and the second line corresponds to September 2015, when the tax was first implemented

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