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In Mexico, Evidence Of Sustained Consumer Response Two Years After Implementing A Sugar-Sweetened Beverage Tax

DOI: 10.1377/hlthaff.2016.1231
HEALTH AFFAIRS 36,
NO. 3 (2017): –
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Foundation, Inc.

ABSTRACT Mexico implemented a 1 peso per liter excise tax on sugar-sweetened beverages on January 1, 2014, and a previous study found a 6 percent reduction in purchases of taxed beverages in 2014. In this study we estimated changes in beverage purchases for 2014 and 2015. We used store purchase data for 6,645 households from January 2012 to December 2015. Changes in purchases of taxed and untaxed beverages in the study period were estimated using two models, which compared 2014 and 2015 purchases with predicted (counterfactual) purchases based on trends in 2012–13. Purchases of taxed beverages decreased 5.5 percent in 2014 and 9.7 percent in 2015, yielding an average reduction of 7.6 percent over the study period. Households at the lowest socioeconomic level had the largest decreases in purchases of taxed beverages in both years. Purchases of untaxed beverage increased 2.1 percent in the study period. Findings from Mexico may encourage other countries to use fiscal policies to reduce consumption of unhealthy beverages along with other interventions to reduce the burden of chronic disease.

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In Mexico the prevalence of overweight and obesity reached 70 percent among adults and 30 percent among children in 2012.^{1,2} Although obesity and all related chronic diseases are the result of a multitude of causes, evidence shows that consumption of sugar-sweetened beverages is associated with weight gain and with diabetes and other chronic diseases.^{3–8}

A nationally representative dietary intake survey conducted in Mexico in 2012 found that 12.5 percent of total daily energy intake comes from added sugars.⁹ This is higher than the World Health Organization's recommended level of less than 10 percent of total energy intake.¹⁰ Sugar-sweetened beverages account for 70 percent of the sugars added to the diet in Mexico, or 9.8 percent of total energy intake, on average.¹¹ Therefore, the beverages are a logical target for lowering the intake of added sugars.

To reduce consumption of the beverages, ef-

fective January 1, 2014, the Mexican government implemented an excise tax of 1 peso per liter on all nonalcoholic beverages with added sugar (including powdered sugar-sweetened beverages based on their reconstitution and flavored or sweetened dairy products that are not milk).¹² The regulation allows for the tax to be adjusted when the cumulative inflation rate compared to January 2014 in Mexico reaches 10 percent.¹³

Evidence for 2014 showed that on average in urban areas, the tax was fully passed on to consumers through increased prices.¹⁴ There were no significant changes in the prices of untaxed beverages—except for diet sodas (which represent a low proportion of untaxed beverages), whose price increased. On average, there was a 6 percent decline in purchases of taxed beverages and a 4 percent increase in purchases of untaxed beverages in 2014.¹⁵

After the peer-reviewed research papers cited above were published, there were statements in

the press claiming that the tax on sugar-sweetened beverages had not reduced purchases of these products in 2015¹⁶ as it had done in 2014. Subsequent investigations into the approaches used by those quoted in the press revealed that their work had various methodological problems: For instance, they had used aggregate sales measures and ignored significant increases in the population's size and changes in its age composition.¹⁷⁻¹⁹

These subsequent investigations have already noted that when one adjusts for seasonality and growth in the population, per capita sales of sugar-sweetened beverages declined in 2015.¹⁷⁻¹⁹ However, these studies do not provide the rigorous analysis needed to understand how the population overall and various socioeconomic groups responded to the tax. In addition, these analyses cannot account for other critical factors that might affect household beverage purchases. It is also important to note that because the cumulative Mexican inflation rate has not reached 10 percent (cumulative inflation in 2014-15 was 6.3 percent)²⁰—the level that triggers an adjustment of the tax, as noted above—it is possible that the gradual effects of inflation eroded the tax value over time. It is also possible that over a longer period of time, some Mexican households adjusted their basket of purchases to allow them to increase purchases of sugar-sweetened beverages²¹ or, on the contrary, that by habit formation, people could reduce consumption of the beverages more in the long run than in the short run.²²

Although some countries (Colombia, Finland, France, Mexico, South Africa, and the United Kingdom) and localities in the United States (such as Albany, Berkeley, Oakland, and San Francisco, California; Boulder, Colorado; and Cook County, Illinois) have proposed or implemented taxes on sugar-sweetened beverages, evidence of changes in purchases or consumption of the beverages after tax implementation is scarce. Recent results from the short-term changes in sugar-sweetened beverage intake in Berkeley show a reduction in the frequency of consumption among lower-income households.²³

We attempted to avoid many of the methodological problems mentioned above by conducting a longitudinal analysis of a panel of Mexican urban households to estimate changes in purchases from stores of taxed and untaxed beverages in 2014 and 2015, the first two years after the implementation of the tax on sugar-sweetened beverages. We analyzed the changes by socioeconomic group and beverage categories.

Study Data And Methods

DATA We used data for January 2012–December 2015 on households' monthly store purchases from Nielsen's Mexico Consumer Panel Services. The data were for a sample of 6,645 Mexican households in fifty-three cities, whose populations ranged from 50,000 to 8.9 million inhabitants.

For each household in the Nielsen survey, the data included sociodemographic variables and information on food and beverages purchased from stores. The data on purchases are based on information that households have to keep to participate in the survey: receipts from purchases in stores, empty packages of food and beverages purchased, and daily reports or diaries of food and beverages purchased. Therefore, the information contained beverage purchases from a variety of stores, markets, and other vendors so long as the beverage had a bar code or packaging that provided information about it (for example, its brand or size). The data did not include information on fountain drinks or hot drinks purchased from food service locations or on tap water consumed.

We classified beverages into categories based on product descriptions and sources available on the Internet and in stores. In this study we focused on taxed and untaxed beverages. The two categories for taxed beverages were carbonated sodas and noncarbonated sugar-sweetened beverages (including powders in their reconstituted form, based on the label). The three categories for untaxed beverages were carbonated drinks such as diet sodas; sparkling or still bottled water; and all other untaxed drinks, including unsweetened dairy beverages, their substitutes (such as unsweetened almond or soy milk), and unsweetened fruit juices. We summed the monthly volume in each of the beverage categories that each household purchased for each of the forty-eight months in our study period. Then, for interpretability, we calculated the volume per capita per day.

EMPIRICAL ESTIMATION In this study we used the same model we employed previously¹⁵ to evaluate changes in purchases in 2014, with two adjustments. First, in this study the model controlled for inflation—which is relevant for the medium-term evaluation of the effects of the tax, as it has not yet been adjusted for inflation. Second, we estimated the association of the tax and purchases in two separate models for each of the posttax years, to allow us to make comparisons to the pretax period. The separate models also ensured that the additional 2015 data did not bias the predicted values upward or downward.

We modeled changes in monthly volume of

purchases (in milliliters per capita per day) of taxed and untaxed beverages. Nielsen's Consumer Panel Service did not collect information on purchases of dairy products from the full sample before October 2012 (Rebeca Rodríguez, product leader, Consumer Panel Service, personal communication, August 7, 2014). Therefore, we excluded data on dairy beverages (which were untaxed) to have comparable data over time for taxed and untaxed beverages. Estimations for untaxed beverages including dairy beverages are presented in the online Appendix.²⁴ We log-transformed the dependent variable, as the distribution of purchases was skewed and was not normally distributed. All zero purchases were kept when log-transforming by adding a small value of 1 ml per capita per day to those purchases.

Nonreporting of a purchase of a beverage can occur as a result of misreporting. The variability in the probability of missing purchase data needed to be accounted for. For each of the beverage categories, if 10 percent or more of the households reported no purchases, we first ran longitudinal probit models for the probability of reporting purchasing (or the probability of missing data). We derived the inverse probability weights as the inverse of the predicted values from these models. Thus, higher weights were given to household-month observations with lower probability of reporting purchases, so that these underrepresented observations were appropriately reflected in the analyses. Because the weights could change over time for any given household, we included them in the fixed-effects model to predict changes in purchases. To do this, we used the `areg` and `absorb` commands in Stata, version 12.

We estimated fixed-effects regression, adjusting for variables that changed with time: annual measures of sociodemographic characteristics of the households (including household size and composition, education of the head of the household, and three groups of socioeconomic levels created based on household assets) and macroeconomic variables such as state quarterly unemployment rates²⁵ and minimum daily salary.²⁶ We adjusted for monthly inflation using the Consumer Price Index for prices collected in forty-six cities in Mexico by the National Institute of Statistics and Geography²⁰ for each corresponding year, month, and city based on household residence. For households in cities where prices were not collected, we used the state average across cities within the state.

We also included month dummies to adjust for seasonality. In previous work we used quarters instead of months.¹⁵ The change allowed us to better represent seasonality, particularly for cer-

tain months (December 2014–February 2015), when a decline in purchases was significantly larger than observed in previous years—in particular, for untaxed beverages.

We ran separate models for each posttax year using the pretax period for comparison with both posttax years: Model 1 compared 2012–13 with 2014, and model 2 compared 2012–13 with 2015. Within each model, we compared the predicted posttax volume of beverages purchased obtained from the model with the predicted volume of beverages that would have been purchased if the tax had not been implemented, based on pretax trends (the counterfactual). The counterfactual for each year was predicted by replacing the dummy variable for the tax with zero for all observations but allowing all other observed variables (including all other time measures) to vary. We conducted the analysis for the full sample and stratified the model by household socioeconomic level and the categories of beverages.

The analytical sample for this study included 270,782 household-month observations for the period January 2012–December 2015 from 6,645 households (an average of 40.7 months of data per household out of the maximum of 48.0).

LIMITATIONS There were some limitations to this research. First, as in all nonexperimental studies, causality could not be established, since other changes occurred simultaneously with the implementation of the tax. We attempted to overcome this limitation by adjusting for contextual economic factors and time trends. While these adjustments make the results more plausible, they may have been insufficient.

Second, concurrently with the implementation of the tax on sugar-sweetened beverages, an 8 percent ad valorem tax was imposed on nonessential energy-dense food, which has shown to be associated with reduced purchases of some of the taxed foods.²⁷ The concurrent tax may have also influenced the demand for beverages.

Third, it is possible that the changes in purchases of taxed beverages might be due not only to the elastic nature of the demand for sugar-sweetened beverages. The changes might also be due to increased awareness of the negative effect of the beverages on health;¹⁰ recommendations by the World Health Organization and the Pan American Health Organization to reduce the intake of the beverages through taxes and other policies;²⁸ or the potential effect of other regulations implemented by the Mexican government—such as the regulation of unhealthy food and beverages in schools and the partial regulation of marketing targeted to children.^{29,30} Conversely, an increase in marketing

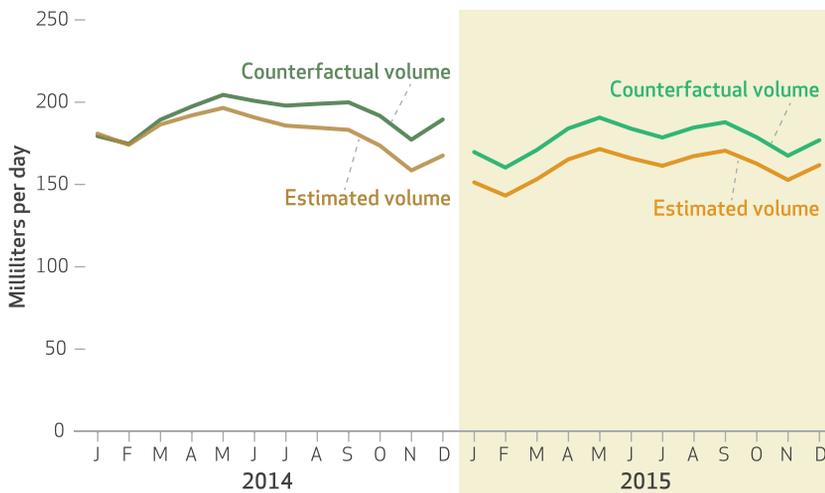
efforts by the beverage industry (such as advertising campaigns and promotions) in the posttax period³¹ might have attenuated the effect of the tax.

Fourth, data on dairy beverage purchases before October 2012 were incomplete, which limited our ability to estimate the overall effect of the tax on untaxed beverage purchases in a consistent manner with other beverages. Fifth, the data were about consumers in cities with more than 50,000 residents. We did not have data about consumers from smaller cities or rural areas.

Finally, average purchases in household surveys tend to be underestimated compared to data from other sources. For example, in 2012 the average per capita per day purchase of taxed beverages in our purchase data was 224.7 ml, compared to 345.2 ml in data from Euromonitor International for off-trade sales (which includes sales from stores but excludes food service sales, such as fountain drinks).³² However, the trends in the difference observed between Nielsen food purchase data compared to Euromonitor data did not change over our study period.

EXHIBIT 1

Estimated and counterfactual volumes of taxed beverages purchased per capita in Mexico, 2014–15



SOURCE Authors' analysis of data for January 2012–December 2015 from Nielsen through its Mexico Consumer Panel Service (CPS) for the food and beverage categories for January 2012–December 2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. **NOTES** Counterfactual volumes are for taxed beverages that would have been purchased in the absence of the excise tax on all nonalcoholic beverages with added sugar, based on trends before the January 1, 2014, implementation of the excise tax. Dairy beverages were excluded because data for January–September 2012 were incomplete. Models adjusted for household size and composition, seasonality, education of the head of the household, household socioeconomic level, and macroeconomic variables. Differences between counterfactual and estimated volumes were all significant ($p < 0.01$).

Study Results

DESCRIPTIVE RESULTS The monthly weighted unadjusted mean purchases for taxed and untaxed beverages (excluding dairy) for the period January 2012–December 2015 are shown in Appendix Exhibits A1 and A2.²⁴ The survey weighted measures for head of household education and region (from the Nielsen Consumer Panel Service and the nationally representative National Income and Expenditure Survey) and population projections for 2014 are shown in Appendix Exhibit A3.²⁴

ADJUSTED ANALYSES OF PURCHASES Exhibit 1 shows the adjusted estimated and counterfactual volumes of taxed beverages purchased in 2014–15. There was an average decline of 5.5 percent in 2014 and an average decline of 9.7 percent in 2015, resulting in an average decline of 7.6 percent for the entire study period (Exhibit 2).

Exhibit 3 shows the adjusted estimated and counterfactual volumes of untaxed beverages purchased in 2014–15. There was an average increase of 5.3 percent in 2014 and an average decrease of 1.0 percent in 2015, for an average increase of 2.1 percent in the entire study period (Exhibit 2).

Exhibit 4 shows the absolute and relative differences between adjusted estimated and counterfactual volumes of taxed and untaxed beverages by household socioeconomic level. There were significant declines in the taxed beverages purchased by households at all socioeconomic levels, but reductions in absolute and relative terms were largest among households at the lowest level (declines of 18.8 ml per capita per day in 2014 and of 29.3 ml per capita per day in 2015). The differences across socioeconomic levels were significant (the confidence intervals did not overlap). For untaxed beverages, households at the middle socioeconomic level had the largest increase in purchases in 2014 (Exhibit 4).

Appendix Exhibit A4²⁴ presents the results of the model for untaxed beverages including dairy beverages. Appendix Exhibit A5²⁴ shows the results of changes in purchases of taxed and untaxed beverages by category of beverage.

Discussion

We estimated changes in purchases of taxed and untaxed beverages for the two years after an excise tax on sugar-sweetened beverages was implemented in Mexico. For taxed beverages, we found an average decline of 7.6 percent in purchases over the study period, compared to what would have happened if the tax had not been implemented. The reduction in taxed beverage purchases was larger in 2015 than in 2014 (9.7 percent and 5.5 percent, respectively). For

untaxed beverage purchases, we found an average increase of 2.1 percent over the study period. Similar to previously published findings for 2014,¹⁵ our results show that households at all three socioeconomic levels reduced their purchases of taxed beverages in 2015, but absolute and relative reductions were largest among the households at the lowest socioeconomic level.

Although the model used in this study adjusted for inflation and included monthly dummies for seasonality, results for taxed beverages were very similar to previous findings for 2014 alone.¹⁵ Results for the two years are also very similar to a recent analysis of sales data from the Encuesta Mensual de la Industrial Manufacturera (Monthly Surveys of the Manufacturing Industry), which found a 7.3 percent reduction in sales of sugar-sweetened beverages two years after the implementation of the tax, compared to 2007–13.¹⁹ Although sales data are less likely to underestimate actual consumption, the data used in the current study allowed a better classification of taxed and untaxed beverages and made it possible to adjust and stratify for variables at the household level that are associated with purchases.

The findings in the current analysis provide empirical evidence similar to model-based price-elasticity studies of demand for sugar-sweetened beverages in the United States, which showed higher price elasticity in the long run than in the short run.²² Economic studies of the use of tobacco and other highly preferred habit-forming items imply that the long-term impact of a price change will be much larger than the short-term effect for tobacco, alcohol, and illicit drugs.^{33–37} The results of our study showing a greater reduction in purchases of sugar-sweetened beverages in Mexico in the second year after implementation of the tax on them suggests that in the case of these beverages, the long-term impact of a price change may also be larger than the short-term effect.

Purchases of taxed sodas declined much less than purchases of nonsoda sugar-sweetened beverages during our study period (Appendix Exhibit A5),²⁴ which was consistent with the first-year results.¹⁵ These findings could partly be explained by the higher prices and price-elasticities of nonsoda sugar-sweetened beverages compared to sodas.³⁸ Given the large variation in prices of sodas, consumers might have shifted to cheaper versions.¹⁴ Moreover, the reduction in purchases of taxed sodas may have been underestimated if purchases of smaller package sizes (which showed a larger increase in price than larger packages after the tax) were not well reported in the data, as beverages in smaller packages may be consumed on the go

EXHIBIT 2

Differences between estimated and counterfactual volumes of taxed and untaxed beverages purchased monthly per capita in Mexico, 2014–15

	Taxed beverages	Untaxed beverages
2014		
January	−0.8%***	10.2%***
February	−0.4%***	9.3%***
March	−1.6%***	8.4%***
April	−2.7%***	7.5%***
May	−3.9%***	6.6%***
June	−5.0%***	5.7%***
July	−6.1%***	4.8%***
August	−7.3%***	3.9%***
September	−8.4%***	3.1%***
October	−9.4%***	2.2%***
November	−10.5%***	1.4%***
December	−11.6%***	0.5%***
2014 average	−5.5	5.3
2015		
January	−10.8%***	−4.4%***
February	−10.6%***	−3.8%***
March	−10.4%***	−3.2%***
April	−10.2%***	−2.6%***
May	−10.0%***	−2.0%***
June	−9.8%***	−1.3%***
July	−9.6%***	−0.7%***
August	−9.4%***	−0.1%***
September	−9.2%***	−0.5%***
October	−9.0%***	1.2%***
November	−8.8%***	1.8%***
December	−8.5%***	2.4%***
2015 average	−9.7	−1.0
2014–15		
Average	−7.6	2.1

SOURCE Authors' analysis of data for January 2012–December 2015 from Nielsen through its Mexico Consumer Panel Service (CPS) for the food and beverage categories for January 2012–December 2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. **NOTES** Counterfactual volumes are for beverages that would have been purchased in the absence of the excise tax on all nonalcoholic beverages with added sugar, based on trends before the January 1, 2014, implementation of the excise tax. Models adjusted for household size and composition, seasonality, education of the head of the household, household socioeconomic level, and macroeconomic variables. Dairy beverages were excluded because data for January–September 2012 were incomplete. ***p < 0.01

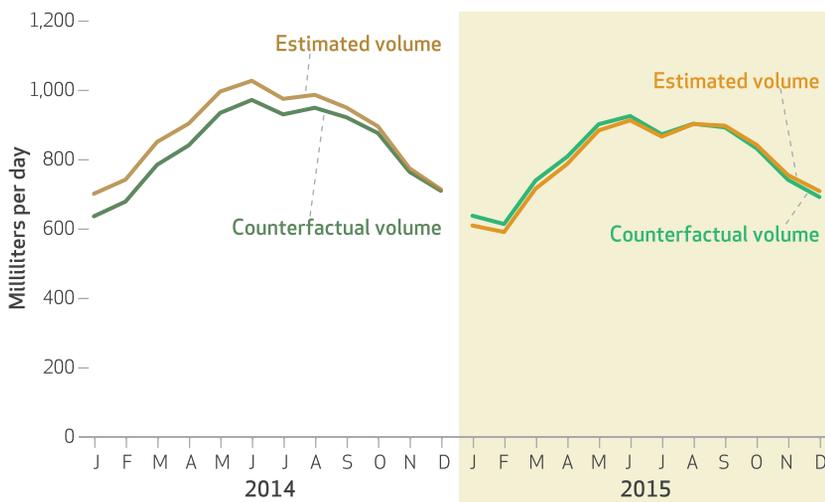
and thus may be underreported by the key household informant.

For untaxed beverages excluding dairy beverages, previous findings showed a 2 percent increase in purchasing and consumption in 2014,¹⁵ which was lower than the 5.3 percent increase in purchases found in this study. The difference is that in the former study, both dairy and other untaxed beverages were excluded, while in this study only dairy beverages were excluded. Other untaxed beverage purchases accounted for about 5 percent of total untaxed beverage purchases and increased substantially in the study period (Appendix Exhibit A5).²⁴

We found a drop in purchases of untaxed beverages in 2015, mainly linked to a large decrease

EXHIBIT 3

Estimated and counterfactual volumes of untaxed beverages purchased per capita in Mexico, 2014–15



SOURCE Authors' analysis of data for January 2012–December 2015 from Nielsen through its Mexico Consumer Panel Service (CPS) for the food and beverage categories for January 2012–December 2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. **NOTES** Counterfactual volumes are for untaxed beverages that would have been purchased in the absence of the excise tax on all nonalcoholic beverages with added sugar, based on trends before the January 1, 2014, implementation of the excise tax. Dairy beverages were excluded because data for January–September 2012 were incomplete. Models adjusted for household size and composition, seasonality, education of the head of the household, household socioeconomic level, and macroeconomic variables. Differences in absolute values comparing the posttax periods with the counterfactuals were all statistically significant at $p < 0.01$.

in purchases of untaxed beverages in the period December 2014–February 2015. In contrast, aggregated per capita sales data for Mexico show an increasing trend of purchases of non-sugar-sweetened beverages since 2001 that continued through 2015.³² In addition, an analysis of data from the Monthly Surveys of the Manufacturing Industry found a 5.2 percent increase in the production sales³⁹ of still bottled water two years after the implementation of the tax, compared to 2007–13—which may indicate that consumers in Mexico are substituting other beverages such as water for sugar-sweetened beverages.¹⁹ Each data source has its limitations, which may be the cause of the discrepancies between aggregate sales data per capita and information on purchases from the households in our study. An analysis of subsequent years of data may clarify the discrepancies.

Conclusion

Overall the results from our study contradict industry reports of a decline in the effect of the tax after the first year of its implementation. We found a greater reduction in purchases of sugar-sweetened beverages in 2015 than in 2014. Moreover, both the absolute and relative reductions were highest among households at lower socioeconomic levels. Future analysis of a national nutrition survey conducted in Mexico in 2016 will determine whether there were shifts in a number of cardiometabolic measures be-

EXHIBIT 4

Differences between estimated and counterfactual volumes of taxed and untaxed beverages purchased per capita per day in Mexico, by household socioeconomic level, 2014 and 2015

Socioeconomic level	Difference, 2014		Difference, 2015		Average, 2014 and 2015	
	Absolute ^a	Relative	Absolute ^a	Relative	Absolute ^a	Relative
TAXED BEVERAGES						
Lowest level	-18.8***	-9.0%	-29.3***	-14.3%	-24.0	-11.7%
Middle level	-12.8***	-5.9	-23.3***	-11.7	-18.0	-8.8
Highest level	-6.9***	-4.4	-8.2***	-5.6	-7.6	-5.1
All levels	-10.6***	-5.5	-17.2***	-9.7	-13.9	-7.6
UNTAXED BEVERAGES						
Lowest level	15.9***	2.4%	-46.3***	-5.9%	-15.2	-1.8%
Middle level	48.5***	5.6	-8.8	-1.2	19.9	2.1
Highest level	39.1	4.5	-11.9	-1.5	13.6	1.2
All levels	43.2	5.3	-7.0	-1.0	18.1	2.1

SOURCE Authors' analysis of data for January 2012–December 2015 from Nielsen through its Mexico Consumer Panel Service (CPS) for the food and beverage categories for January 2012–December 2015 (The Nielsen Company, 2016). Nielsen is not responsible for and had no role in preparing the results reported herein. **NOTES** Counterfactual volumes are for beverages that would have been purchased in the absence of the excise tax on all nonalcoholic beverages with added sugar, based on trends before the January 1, 2014, implementation of the excise tax. Socioeconomic levels were determined based on household asset ownership. Models adjusted for household size and composition, seasonality, education of the head of the household, household socioeconomic level, and macroeconomic variables. Dairy beverages were excluded because data for January–September 2012 were incomplete. ^aMilliliters per capita per day. *** $p < 0.01$

tween 2012 and 2016 as well as in dietary patterns. Together with further future analyses of food purchase data, the analyses of the 2016 national nutrition survey will provide a better understanding of the longer-term implications for consumer beverage purchasing and consumption behavior of the excise tax on sugar-sweetened beverages.

International agencies such as the World Health Organization and the Pan American Health Organization have recommended implementing taxes to discourage the consumption of unhealthy food and beverages though increases in relative prices.^{28,40} The results of our evaluation of the effects of the tax on sugar-sweetened beverages in Mexico revealed an average reduction of 7.6 percent in purchases of the beverages in the first two years after the tax took effect. These reductions in consumption could have positive impacts on health outcomes and reductions in health care expenses in Mexico, as

shown in a recently published simulation model.⁴¹ As our study showed, decreases in purchases were greater among households at the low socioeconomic level than those at higher levels, which could lead to higher health care savings for the country as well as for individuals.

Given the sustained effect of the tax on sugar-sweetened beverages over a two-year period and findings that responses to prices of cigarettes (price-elasticities) increase monotonically with prices,^{42,43} the impact of the tax on sugar-sweetened beverages in Mexico could be increased by raising the tax to at least 2 pesos per liter (resulting in a 20 percent increase in price). At the global level, findings on the sustained impact over two years of taxes on the beverages in Mexico may encourage other countries to use fiscal policies to reduce the consumption of unhealthy beverages along with other interventions to reduce the burden of chronic diseases. ■

Funding came primarily from Bloomberg Philanthropies (grants to the University of North Carolina and to the Mexican National Institute of Public Health), with additional support from the National Institutes of Health (NIH) (Grant No. R01DK108148), the Robert Wood Johnson Foundation (Grant No. 71698),

and the Carolina Population Center at the University of North Carolina (through the center's NIH Grant No. P2C HD0550924). The funders had no direct role in the study design, analysis, or manuscript preparation. Juan Rivera-Dommarco and Barry Popkin have collaborated on a randomized controlled

trial on water consumption funded by the Danone Research Center. The authors thank Donna Miles for exceptional assistance with the data management and Frank Chaloupka and Harold Alderman from the evaluation advisory committee. [Published online February 22, 2017.]

NOTES

- Barquera S, Campos-Nonato I, Hernández-Barrera L, Pedroza A, Rivera-Dommarco JA. Prevalence of obesity in Mexican adults 2000–2012. *Salud Publica Mex.* 2013; 55(Suppl 2):S151–60.
- Rivera JA, de Cossío TG, Pedraza LS, Aburto TC, Sánchez TG, Martorell R. Childhood and adolescent overweight and obesity in Latin America: a systematic review. *Lancet Diabetes Endocrinol.* 2014;2(4):321–32.
- Malik VS, Popkin BM, Bray GA, Després JP, Willett WC, Hu FB. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes Care.* 2010;33(11):2477–83.
- Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. *Am J Clin Nutr.* 2006;84(2):274–88.
- Te Morenga L, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ.* 2012;346:e7492.
- Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. *Am J Public Health.* 2007; 97(4):667–75.
- Pérez-Escamilla R, Obbagy JE, Altman JM, Essery EV, McGrane MM, Wong YP, et al. Dietary energy density and body weight in adults and children: a systematic review. *J Acad Nutr Diet.* 2012;112(5):671–84.
- World Cancer Research Fund, American Institute for Cancer Research. Food, nutrition, physical activity, and the prevention of cancer: a global perspective [Internet]. Washington (DC): AICR; 2007 [cited 2017 Jan 27]. Available from: http://www.aicr.org/assets/docs/pdf/reports/Second_Expert_Report.pdf
- Sánchez-Pimienta TG, Batis C, Lutter CK, Rivera JA. Sugar-sweetened beverages are the main sources of added sugar intake in the Mexican population. *J Nutr.* 2016;146(9): 1888S–96S.
- World Health Organization. Guideline: sugars intake for adults and children [Internet]. Geneva: WHO; c 2015 [cited 2017 Jan 27]. Available from: http://apps.who.int/iris/bitstream/10665/149782/1/9789241549028_eng.pdf?ua=1
- Aburto TC, Pedraza LS, Sánchez-Pimienta TG, Batis C, Rivera JA. Discretionary foods have a high contribution and fruit, vegetables, and legumes have a low contribution to the total energy intake of the Mexican population. *J Nutr.* 2016;146(9):1881S–7S.
- Secretaría de Gobernación. Ley del impuesto especial sobre producción y servicios [Excise Tax Law for Production and Services] [Internet]. Mexico City: Secretaría de Gobernación; 2013 Nov 12 [cited 2017 Jan 27]. Available from: http://www.dof.gob.mx/nota_detalle.php?codigo=5325371&fecha=11/12/2013
- Secretaría de Gobernación. Código Fiscal de la Federación [Fiscal Federation Code] [Internet]. Mexico City: Secretaría de Gobernación; 2004. Artículo 17-A [article 17-A]; [cited 2017 Feb 14]. Available from: http://www.diputados.gob.mx/LeyesBiblio/pdf/8_270117.pdf
- Colchero MA, Salgado JC, Unar-Munguía M, Molina M, Ng S, Rivera-Dommarco JA. Changes in prices after an excise tax to sweetened sugar beverages was implemented in Mexico: evidence from urban areas. *PLoS One.* 2015;10(12): e0144408.
- Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. *BMJ.* 2016;352:h6704.
- Guthrie A, Esterl M. Soda sales in

- Mexico rise despite tax. *Wall Street Journal*. 2016 May 3.
- 17 Instituto Nacional de Salud Pública. Why it is not possible to make determinations on the usefulness of the tax on sugar sweetened beverages in Mexico during 2015 using raw sales data [Internet]. Cuernavaca: INSP; [cited 2017 Jan 27]. Available from: <https://www.insp.mx/epppo/blog/4063-tax-sugar-sweetened-beverages.html>
 - 18 Cherukupalli R. Growth rates and aggregates: bringing data to the soda wars. *Lancet Global Health Blog* [blog on the Internet]. 2016 Jun 10 [cited 2017 Jan 27]. Available from: <http://globalhealth.thelancet.com/2016/06/10/growth-rates-and-aggregates-bringing-data-soda-wars>
 - 19 Colchero MA, Guerrero-López CM, Molina M, Rivera JA. Beverages sales in Mexico before and after implementation of a sugar sweetened beverage tax. *PLoS One*. 2016;11(9):e0163463.
 - 20 Instituto Nacional de Estadística y Geografía. Índices de Precios [Internet]. Aguascalientes: INEGI; c 2011 [cited 2017 Jan 27]. Available from: <http://www.inegi.org.mx/est/contenidos/proyectos/inp/default.aspx>
 - 21 Leicester A, Level P, Rasul I. Tax and benefit policy: insights from behavioural economics [Internet]. London: Institute for Fiscal Studies; 2012 Jul 24 [cited 2017 Jan 27]. Available from: https://www.ifs.org.uk/conferences/hmrc24jul_al.pdf
 - 22 Zhen C, Wohlgenant MK, Karns S, Kaufman P. Habit formation and demand for sugar-sweetened beverages. *Am J Agric Econ*. 2011;93(1):175–93.
 - 23 Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *Am J Public Health*. 2016;106(10):1865–71.
 - 24 To access the Appendix, click on the Appendix link in the box to the right of the article online.
 - 25 Instituto Nacional de Estadística y Geografía. Encuesta Nacional de Ocupación y Empleo (ENOE) [National Occupation and Employment Survey] [Internet]. Aguascalientes: INEGI; [cited 2017 Jan 27]. Available from: <http://www.inegi.org.mx/est/contenidos/Proyectos/encuestas/hogares/regulares/enoe>
 - 26 Secretaría del Trabajo y Previsión Social. Tabla de salarios mínimos generales y profesionales por áreas geográficas [Minimum wages: general and professional by geographic location] [Internet]. Cuauhtémoc: Secretaría del Trabajo y Previsión Social; [cited 2017 Jan 27]. Available from: http://www.conasami.gob.mx/t_sal_mini_prof.html
 - 27 Batis C, Rivera JA, Popkin BM, Taillie LS. First-year evaluation of Mexico's tax on nonessential energy-dense foods: an observational study. *PLoS Med*. 2016;13(7):e1002057.
 - 28 Pan American Health Organization, World Health Organization. Plan of action for the prevention of obesity in children and adolescents [Internet]. Washington (DC): PAHO; 2014 Oct 3 [cited 2017 Jan 27]. Available for download from: http://www.paho.org/hq/index.php?option=com_content&view=article&id=11373%3Aplan-of-action-prevention-obesity-children-adolescents&catid=4042%3Areference-documents&Itemid=41740&lang=en
 - 29 Gobierno de la República. Estrategia nacional para la prevención y el control del sobrepeso, la obesidad y la diabetes [National strategy for the prevention and control of overweight, obesity, and diabetes] [Internet]. Mexico City: Gobierno de la República; 2013 Sep [cited 2017 Jan 27]. Available from: http://promocion.salud.gob.mx/dgpps/descargas1/estrategia/Estrategia_con_portada.pdf
 - 30 Théodore FL, Tolentino-Mayo L, Hernández-Zenil E, Bahena L, Velasco A, Popkin B, et al. Pitfalls of the self-regulation of advertisements directed at children on Mexican television. *Pediatr Obes*. 2016 May 2. [Epub ahead of print].
 - 31 Instituto Nacional de Salud Pública. Estrategias de mercadotecnia de la industria de bebidas azucaradas [Marketing strategies of the beverage industry] [Internet]. Cuernavaca: INSP; [cited 2017 Jan 27]. Available from: <https://www.insp.mx/epppo/blog/3811-estrategias-industria-bebidas.html>
 - 32 Euromonitor International. Global insight for organisational growth [Internet]. London: Euromonitor International's Passport; [cited 2017 Feb 7]. Available from: <http://go.euromonitor.com/passport.html>
 - 33 Jensen JD, Smed S. The Danish tax on saturated fat—short run effects on consumption, substitution patterns and consumer prices of fats. *Food Policy*. 2013;42(C):18–31.
 - 34 Becker GS, Murphy KM. A theory of rational addiction. *J Polit Econ*. 1988;96(4):675–700.
 - 35 Grossman M, Chaloupka FJ. The demand for cocaine by young adults: a rational addiction approach. *J Health Econ*. 1998;17(4):427–74.
 - 36 Gruber J, Köszegi B. Is addiction “rational”? Theory and evidence. *Q J Econ*. 2001;116(4):1261–303.
 - 37 Guindon GE, Paraje GR, Chaloupka FJ. The impact of prices and taxes on the use of tobacco products in Latin America and the Caribbean. *Am J Public Health*. 2015;105(3):e9–19.
 - 38 Colchero MA, Salgado JC, Unar-Munguía M, Hernández-Ávila M, Rivera-Dommarco JA. Price elasticity of the demand for sugar sweetened beverages and soft drinks in Mexico. *Econ Hum Biol*. 2015; 19:129–37.
 - 39 Production sales here refers to the volume of beverages manufactured in Mexico. It includes beverages that are exported outside Mexico and excludes beverages that are imported into Mexico.
 - 40 World Health Organization. Fiscal policies for diet and prevention of noncommunicable diseases: technical meeting report [Internet]. Geneva: WHO; c 2016 [cited 2017 Jan 27]. Available from: <http://apps.who.int/iris/bitstream/10665/250131/1/9789241511247-eng.pdf?ua=1>
 - 41 Sánchez-Romero LM, Penko J, Coxson PG, Fernández A, Mason A, Moran AE, et al. Projected impact of Mexico's sugar-sweetened beverage tax policy on diabetes and cardiovascular disease: a modeling study. *PLoS Med*. 2016;13(11):e1002158.
 - 42 Tauras JA, Pesko MF, Huang J, Chaloupka FJ, Farrelly MC. The effect of cigarette prices on cigarette sales: exploring heterogeneity in price elasticities at high and low prices [Internet]. Cambridge (MA): National Bureau of Economic Research; 2016 May [cited 2017 Jan 27]. (NBER Working Paper No. 22251). Available from: <http://www.nber.org/papers/w22251.pdf>
 - 43 Pesko MF, Tauras JA, Huang J, Chaloupka FJ IV. The influence of geography and measurement in estimating cigarette price responsiveness [Internet]. Cambridge (MA): National Bureau of Economic Research; 2016 Jun [cited 2017 Jan 27]. (NBER Working Paper No. 22296). Available from: <http://www.nber.org/papers/w22296.pdf>