

# Preventing Non-Communicable Diseases Using Pricing Policies: Lessons for the United States from Global Experiences and Local Pilots

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Policies to prevent non-communicable diseases (NCDs) such as diabetes, hypertension, cardiovascular diseases, and cancers should be important national and local priorities for several reasons. First, the current prevalence of NCDs is alarming, with 73% of the world's population expected to die from an NCD.<sup>1</sup> NCD prevalence is higher in developed countries compared with developing countries, but age-standardized mortality rates are generally rising in developing countries, which represent a large and rapidly growing share of the world's population,<sup>2</sup> while declining in developed countries.<sup>3</sup> Second, there are clear links between NCDs and the severity and mortality of infectious diseases such as coronaviruses and

## Key Findings

- There are already examples from across the globe including from within the United States that show how pricing policies can help prevent non-communicable diseases (NCDs).
- At the same time, there are still unknowns around how the design, targeting, level, sequencing, integration, and implementation of pricing policies together can maximize their NCD prevention potential.
- Policies alone may not succeed; political will to prioritize wellbeing, protections against industry interference, and public buy-in are necessary.
- If these elements align, pricing policies that consider the context in question can be designed and implemented to achieve several goals around reducing consumption of unhealthy beverages and foods, narrow existing nutritional and health disparities, and encourage economic and social development.

tuberculosis.<sup>4</sup> People with NCDs have weakened immune function and more widespread inflammation, and vaccines or treatments for infectious diseases (like COVID-19) may not work as well for them.<sup>4</sup> Even when only accounting for healthcare costs (borne by public and private entities and individuals), economic costs of NCDs are large and are certainly worse when lost productivity of both the ill and their caregivers are also accounted for.<sup>5</sup> Moreover, NCD-related costs are a larger burden for already low-resourced communities and individuals across most countries, thus widening existing income and sociodemographic disparities.

According to the World Health Organization (WHO), preventive policies are the most cost-effective actions countries can undertake to reduce the health and economic burdens of NCDs.<sup>6</sup> Pricing policies on foods and beverages to increase the price of unhealthy beverages and foods (e.g., taxation, tariffs) or to decrease the price of healthier beverages and foods (e.g., subsidies, cash transfers) are one of the NCD prevention approach governments have used or considered.<sup>7</sup> This brief summarizes the existing literature through a narrative review of papers based around two major questions: What can the United States learn from other countries' experience in designing and implementing pricing policies on food and beverages as part of their NCD prevention strategies? What knowledge gaps remain and how can US jurisdictions take the lead in informing on these policy debates and lessons for other US jurisdictions and other countries?

### Pricing Policies to Change Relative Prices of Foods

#### Taxing SSBs and Other Unhealthy Foods

Taxes are a critical pillar of NCD prevention and have been applied to tobacco, alcohol, and more recently sugar-sweetened beverages (SSBs). They are often collectively called "health taxes."<sup>7,8</sup> The basic principle is that imposing or increasing taxes on these items will result in higher prices, lower consumption, and thus are a way to prevent or minimize the development of future cases of related NCDs. To date, over 45 countries, cities, or regions within countries have instituted SSB taxes, including eight US localities.<sup>9,10</sup> Studies assessing SSB taxes have used price changes and consumption changes (purchases, sales, or intakes) as primary outcomes. Overall, price changes from taxation are heterogeneous and highly dependent on key factors such as the levels of consumption, tax design, market shares of beverage brands given the geographical coverage of the tax, and strategic behaviors by beverage companies and retailers.<sup>11,12</sup> Consequently, changes in purchases and consumption are also heterogeneous, particularly across income levels, age groups, and prior beverage consumption levels.<sup>12-14</sup> Nonetheless, global meta-analysis shows that the average consumer will lower their SSB purchase by 10% if SSB prices rise 10% (implied price elasticity of demand of  $-1$ ),<sup>15</sup> whereas a meta-analysis limited to the Americas shows that the implied price elasticity of demand is  $-1.36$ .<sup>16</sup>

There is slower momentum around food taxes for two reasons. First, they are more difficult to justify because foods are more complex mixtures of nutrients whereas SSBs have no nutritional value. Second, there are concerns around such taxes creating a higher burden among people who are poor. However, there is mounting evidence showing that increased

proportions of ultra-processed products (UPPs) in diets are linked with increased risk of obesity; many measures of cardiovascular disease, diabetes, hypertension, mortality, and cancers; and related mortality and total mortality.<sup>17-33</sup> As such, when the economic burden of having these diseases is accounted for, the poor may benefit when taxes are imposed on unhealthy foods.

Meanwhile, UPPs are gaining popularity globally,<sup>34-40</sup> forming a growing share of the diets of people who are very poor and now reaching infants and preschoolers.<sup>41-47</sup> In countries with available data (mostly emerging economies and high-income countries), SSBs represent about 2%–7% of food purchases and 4%–10% of kcal/day, whereas UPPs (which include SSBs) represent 17% to over 25% of purchases (15%–60% of kcal/day) based on the age-gender group and country. Indeed, previous policy simulations show that if Chile implemented an unhealthy UPP tax aligned with their innovative and integrated food labeling and marketing regulations, there would be clinically meaningful reductions in household purchases of attributes of concern (sugar, sodium, saturated fats) linked with the most common NCDs primarily from the targeted unhealthy UPPs.<sup>48,49</sup> Such a broad-based tax on unhealthy UPPs builds on the two known and evaluated national taxes on some subset of UPPs in Mexico's non-essential food tax and Hungary's junk food tax.<sup>50-52</sup> Both showed significant reductions in the purchases of the targeted products, albeit tempered by their low tax rates (and hence small effect size).

Table A.1 in the Appendix lays out select examples of SSB or unhealthy food taxes and evidence to date spanning measurements on price changes, purchase or sales changes, and consumption changes as well as the revenue uses (when known). The findings to date show more responsiveness to excise taxes collected from manufacturers, distributors, or importers (rather than via sales taxes). Among excise taxes, reductions in sales or purchases have been found, but reductions in intake are less clear or statistically insignificant, likely because of small sample sizes and higher probability of mismeasurements from self-reported consumption data. Meanwhile, these taxes do not appear to have affected employment, revenues, or stock market values of the food and beverage industries, likely because of mitigating responses via reformulations, shifting portfolios or market shares toward untaxed products, or removing past price promotions. Consequently, taxes to date demonstrate strong promise for changing demand and supply of unhealthy beverages and foods. However, there is also some emerging evidence that sugar content-based taxes, although more effective in encouraging sugar reduction, are being avoided with a growing number of non-nutritive sweeteners in products, the

long-term health implications of which are inconclusive at this time.<sup>53</sup> Indeed, it should be expected that any tax targeting current products or attributes of concern will be met with subsequent introductions of new ingredients and products and substitutions among consumers with an alternative product that may or may not be supportive of health. Therefore, researchers and regulatory agencies must be vigilant and thoughtful in establishing mechanisms (e.g., requiring products to declare the amounts of non-nutritive sweeteners and new additives) with which to periodically and quickly assess improve these regulations to ensure that they evolve with the food landscape to best protect people's health.

Health implications on a population level (e.g., flattening of diabetes prevalence rates or reductions in obesity incidence) will take years to emerge, so researchers have used consumption changes to estimate longer-term health and economic implications. These broadly show meaningful reductions in incidence and prevalence of NCDs and thus healthcare cost savings in all countries studied to date.<sup>54–59</sup>

### Decreasing Prices or Increasing Affordability of Healthier Alternatives

Lowering the prices or increasing the affordability of healthier alternatives are also viable pricing policies. One approach is to shift the existing tax structure to create larger price differentials between products of concern versus those considered healthier. For example, Chile went from a 13% ad valorem tax on beverages to 0% for plain waters and plain dairy-based drinks, 10% for all non-alcoholic beverages with sweeteners and <6.25 g sugar, and 18% for all non-alcoholic beverages with sweeteners and ≥6.25 g sugar. Because of the relatively small price increase for higher sugar drinks (+5% points) and the small decrease in prices of lower sugar drinks (–3% points) from the prior 13% tax rate, evaluations of this tax restructure have shown that the price changes were partially absorbed by suppliers, and purchase changes were consequently small.<sup>60</sup> Similarly, efforts to lower costs of healthy foods (e.g., agricultural subsidies or removal of past taxes on producers) are often only partially passed on as price reductions for the public<sup>61</sup> and so are not necessarily an effective way for governments to be spending or lowering revenue if a key purpose is to change consumption behavior.

Another approach that more directly influences choices is to increase the ability for the population to afford healthier alternatives.<sup>62,63</sup> This can be especially effective when targeted toward lower-income populations because it can serve two purposes by addressing equity concerns particularly when paired with tax policies to counter regressivity arguments and by providing reinforcing messages about what are healthier options vs unhealthy ones. In many countries, cash transfers

have been the primary method used to bolster purchasing power. This is typically targeted toward specific subpopulations that need to meet eligibility criteria (e.g., income and asset ownership, age, health condition) and are critical mechanisms for delivering healthy food assistance.

### Lessons for the United States from Abroad and Within

#### Tax Design and Implementation Considerations for the United States

Findings to date suggest that future health taxes in the United States and elsewhere should consider the following issues. First, the baseline levels of consumption of various UPPs for the country and by subgroup (especially by income) and price elasticities of demand is important to understand. These will inform on the scope of products covered by the tax, substitutions and the level of tax to result in purchase changes.

Second, the tax structure should be aligned with the primary objectives. If the goal is sugar reduction, then a sugar density–based tax structure will achieve this more effectively, as suggested by recent findings in Portugal and the United Kingdom on their SSB taxes.<sup>64,65</sup> Likewise, a tax on non-essential UPPs defined based on a country's food-based dietary guidelines and the NOVA classification system<sup>66</sup> could be based on tiered nutrient cutpoints for UPPs with higher tax levels for products with nutrients of concern in excess of these cutpoints. If the goal is revenue generation, then a specific volume-based tax across a broader scope of unhealthy foods or beverages may result in greater tax revenue given a weaker incentive to reformulate but also less public support. Meanwhile, ad valorem taxes on SSBs have been shown to have lower pass-through onto prices compared with specific taxes, with sales taxes being particularly ineffective.<sup>67</sup> For food taxes, ad valorem taxes would be more feasible to implement given very large variations in prices across food categories, but again, there should be higher tax rates for UPPs with more or a higher density of the nutrients of concern. If the goal is equity enhancement, then impacted communities' needs and agency will need to be incorporated into the decision-making process and identification of the objectives of the tax.<sup>68</sup> Additionally, the geographical coverage of the tax jurisdiction has implications on the ease of cross-border shopping and highlights the need for national- or province-/state-level taxes over local taxes (although some countries are small and surrounded by other countries without similar taxes).

Third, one critical concern from a health perspective is how much the attributes of concern (e.g., sugar or calories) are reduced. Although these taxes affect high-income consumers less and lower-income consumers more,<sup>13,52</sup> evaluations



to date suggest the reductions from SSB tax levels to date only translate to 5–22 kcals per capita per day. Even if these reductions are sustained, they are unlikely to have meaningful impacts on the broad swath of health outcomes in a timely manner though research shows the 10–20–year time horizon will produce important results.<sup>57,69</sup> One way to accelerate this is to increase the current tax rates. A few Gulf states have instituted 50%–100% excise taxes on different subsets of SSBs and Bermuda has implemented a 75% import tax on sugar, SSBs and candies. While originally considered infeasible, tax levels for tobacco in some locations now have tax rates ranging from 100%–1000%, and an annual tax raise of \$1 or more is often seen.<sup>70,71</sup> Thus, increases in tax levels for SSBs or non-essential foods over time might be possible.

In findings to date, taxes levied directly on and collected from manufacturers and distributors are easier to enforce and allow producers of taxable products to determine whether and how to pass-through the tax across their portfolio of products. These excise taxes can be built into existing collection systems. Moreover, the US Food and Drug Administration already requires and recently updated nutrition label regulations that facilitate nutrient-based tax designs. This provides a clear and consistent message to both manufacturers and consumers in terms of what items are discouraged. Taxes levied directly on suppliers also help with the framing of the tax as aiming to improve food offerings rather than simply functioning as a revenue raiser with the tax burden falling on the public. Indeed, the public's understanding and perception of the intention of such taxes will be critical in shifting social norms and thus lowering demand for SSBs and UPPs. Therefore, complementary educational campaigns and grassroots movements to increase the tax salience with clear links to health implications or revenue use, such as what has been done in the case of tobacco<sup>72,73</sup> and successful SSB tax efforts to date.<sup>74</sup>

Given the United States's governance structure, local- or state-level governments implementing fiscal policies can serve as pilots from which other locations (United States or globally) can learn. This may be especially valuable when national-level fiscal policies may prove to be untenable and proofs of concepts are necessary. However, this may also create representation challenges because of policy passage selectivity. For example, four of the eight locations in the United States with SSB taxes are in California (Albany, Berkeley, Oakland, and San Francisco). Moreover, concentrations of these taxes in states may result in strong lobbying efforts by industry at the state level to push for preemption laws (e.g., Arizona, California, Washington, Michigan) to prevent other local jurisdictions from following suit.<sup>74–76</sup>

### Tax Revenue Use

One way that local US jurisdictions have been trailblazers has been around determining revenue use. In the US localities with SSB excise taxes, many have included the creation of local commissions or committees tasked to do determine revenue use. An evaluation of community investments from SSB tax revenues in Albany, Berkeley, Oakland, and San Francisco provide useful guidance.<sup>77</sup> Use of those revenues include funding existing programs like the [Berkeley Unified School District's garden program](#) and capital improvement projects in Oakland's parks and recreation department as well as new programs like adding water stations in schools and educational programs for pre-diabetic adults on lifestyle changes through the YMCA.<sup>77</sup> This allows for trifold action via lowering demand for unhealthy beverages, generating revenue to use for lowering prices of healthy foods for individuals with low incomes, and communicating a consistent message. Applying an equity-enhancing approach provides agency over the purpose of health taxes<sup>68</sup> to communities impacted by the harms of SSBs and UPPs and can help garner support around local “health” or “health-promoting” taxes because there is an explicit connection to health. Overtly revenue-driven tax policies are often seen as money-grabs, associated with fiscal mismanagement by governments, and are income regressive in nature. Therefore, to the extent that governments or advocates of such policies can communicate their revenue use in compelling ways to support communities' needs (even without strict earmarking), they can boost public support for such measures.

### Supporting Healthier Eating

With regards to supporting healthier eating, there are also already examples of how local US jurisdictions are modeling approaches to use “healthy food pricing incentives” toward NCD prevention efforts while enhancing equity. These incentives can come in the form of subsidies, rebates, discounts, and matches, and they have primarily focused on fruits and vegetables to date because moderate to good quality evidence supports the use of pricing incentives to increase consumption or purchase of fruits and vegetables.<sup>78</sup>

Organizations across the United States have been experimenting with targeted incentive programs through Medicare and Medicaid among beneficiaries of assistance programs—such as Temporary Assistance for Needy Families (TANF), Supplementary Nutrition Assistance Program (SNAP), and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—who have diet-sensitive health conditions (e.g., hypertension, diabetes).<sup>62</sup> Such “healthy food prescriptions” provide increased financial access to healthy options in stores or at farmers markets via

added benefits for qualifying foods through pilot programs such as SuperSNAP (currently in 42 counties in North Carolina) and Wholesome Wave, which are funded by a mixture of federal grants and private foundations. These programs are identifying and creating innovative approaches for involving retailers, local farmers, software developers, data scientists, and clinicians to manage incentive transfers and to track purchase, utilization, and health outcomes. With the current economic, social, and health threat caused by COVID-19, the expansion of these options is more pressing than ever. Investments into these innovative programs that allow at-risk populations (e.g., low-income populations of children, elderly people, and families) to access nutritious foods are critical for preventing both NCDs and the severity of infectious diseases like COVID-19.

However, such incentive efforts may not be directly transferable or scalable outside of high-income countries with existing funding or technological and implementation capacities. Indeed, most studies have occurred in the United States (19 studies) and other high-income countries (8 studies), with only one study each in Peru and South Africa.<sup>78</sup> Nonetheless, there are elements of incentive programs analogous to cash transfer programs in low- and middle-income countries (LMICs) in terms of targeting (e.g., Bolsa Família in Brazil), many of which have been evaluated and monitored over decades. Funds from health taxes could be directed toward supporting such social support programs, improving school feeding programs or being reinvested into communities based on their needs.

### Remaining Knowledge Gaps

As more countries and localities implement health taxes, we will continue to learn from them and find ways to improve their design and implementation to maximize their potential for NCD prevention, particularly among individuals with low resources. However, we are still learning how these designs can best improve health because changes in health outcomes will take many years to manifest. This makes establishing causality difficult. In addition, it is well accepted that any single policy (unless extremely dramatic and covers a significant share of unhealthy consumption) will unlikely result in fast improvements, thus requiring multi-prong policies (e.g., integrating labeling, marketing restrictions, and tax policies) and accompanying implementation, outcome, and impact evaluations designed to assess the additive or multiplicative associations of these policies together. Finally, our understanding of how the various combinations of foods, ingredients, and chemicals we are exposed to affects our health is still evolving. Therefore, policy designs based on these attributes also need to evolve.

Meanwhile, healthy incentives are understandably popular but can be expensive and thus should be carefully designed and implemented to improve NCD prevention cost-effectiveness. Critical design decisions include the target population; how to determine eligibility or whether to make it conditional on certain behaviors (vs. making it too difficult to enroll and use); length of eligibility; frequency/cycle of disbursement; the amount of incentive; and food selections covered, their baseline levels of consumption, and substitutes.<sup>78</sup> Important implementation decisions are needed around the modes of enrollment, disbursement, and redemption; frequency of benefits; and incorporating reminders and nutrition education.<sup>78</sup> Evaluations of pilot programs should incorporate cost-benefit or cost-effectiveness analyses to help determine how to improve these incentive programs most strategically to maximize their impact and narrow health disparities. Finally, although our focus here is in terms of NCD prevention, given the costs of such programs, the political feasibility of such efforts could be bolstered when they also serve to improve educational outcomes, support the local economy, enhance agricultural practices, and link with educational or other social outcomes.

### Summary

Preventing NCDs in effective and sustainable ways will require forward-looking policy solutions that can address multiple objectives. This was true before COVID-19 and is even more true now. There are already examples from across the globe and within the United States that show how these solutions may be possible. Although there are still many unknowns around how the design, targeting, level, sequencing, integration, and implementation of fiscal policies can together maximize their NCD prevention potential, there is already clear evidence that health taxes—particularly SSB taxes—are cost-effective.<sup>8,79</sup> Future expansions of the WHO OneHealth tool to incorporate such pricing policies in reducing the burden of NCDs are needed.<sup>80</sup> Nonetheless, policies alone may not succeed. Political will to prioritize well-being, protections against industry interference, and public buy-in are necessary. If those elements align, pricing policies that consider the context in question can be designed and implemented to achieve several goals around reducing consumption of unhealthy SSBs and foods, narrow existing nutritional and health disparities, and encourage economic and social development. The United States and its local and state jurisdictions should consider these pricing policy issues and their contexts carefully, in collaboration with community partners and researchers, to design multi-duty actions and to be prepared for future windows of opportunities to open for policy passage and implementation.

## References

1. Roth GA, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N et al.; GBD 2017 Causes of Death Collaborators. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392(10159):1736–88. [https://doi.org/10.1016/S0140-6736\(18\)32203-7](https://doi.org/10.1016/S0140-6736(18)32203-7)
2. Ghebreyesus TA. Acting on NCDs: counting the cost. *Lancet* 2018;391(10134):1973–4. [https://doi.org/10.1016/S0140-6736\(18\)30675-5](https://doi.org/10.1016/S0140-6736(18)30675-5)
3. Prabhakaran D, Anand S, Watkins D, Gaziano T, Wu Y, Mbanyana JC, et al. Cardiovascular, respiratory, and related disorders: key messages from Disease Control Priorities, 3rd edition. *Lancet* 2018;391(10126):1224–36. [https://doi.org/10.1016/S0140-6736\(17\)32471-6](https://doi.org/10.1016/S0140-6736(17)32471-6)
4. National Academies of Sciences, Engineering, Medicine. The convergence of infectious diseases and noncommunicable diseases: proceedings of a workshop. Washington (DC): The National Academies Press; 2019.
5. Nugent RA, Husain MJ, Kostova D, Chaloupka F. Introducing the PLOS special collection of economic cases for NCD prevention and control: a global perspective. *PLoS One* 2020;15(2):e0228564. <https://doi.org/10.1371/journal.pone.0228564>
6. Bertram MY, Sweeny K, Lauer JA, Chisholm D, Sheehan P, Rasmussen B et al. Investing in non-communicable diseases: an estimation of the return on investment for prevention and treatment services. *Lancet* 2018;391(10134):2071–8. [https://doi.org/10.1016/S0140-6736\(18\)30665-2](https://doi.org/10.1016/S0140-6736(18)30665-2)
7. Task Force on Fiscal Policy for Health. Health taxes to save lives: employing effective excise taxes on tobacco, alcohol, and sugary beverages. New York: Bloomberg Philanthropies; 2019.
8. Summers LH. Taxes for health: evidence clears the air. *Lancet* 2018;391(10134):1974–6. [https://doi.org/10.1016/S0140-6736\(18\)30629-9](https://doi.org/10.1016/S0140-6736(18)30629-9)
9. University of North Carolina. Sugary drink taxes around the world. 2021 Apr [cited 2021 May 4]. [https://globalfoodresearchprogram.web.unc.edu/wp-content/uploads/sites/10803/2021/04/SSB\\_sugary\\_drink\\_taxes\\_maps.pdf](https://globalfoodresearchprogram.web.unc.edu/wp-content/uploads/sites/10803/2021/04/SSB_sugary_drink_taxes_maps.pdf)
10. World Cancer Research Fund International. NOURISHING database. [cited 2020 Jun 18]. [https://policydatabase.wcrf.org/level\\_one?page=nourishing-level-one](https://policydatabase.wcrf.org/level_one?page=nourishing-level-one)
11. Salgado JC, Ng SW. Understanding heterogeneity in price changes and firm responses to a national unhealthy food tax in Mexico. *Food Policy* 2019;89:101783. <https://doi.org/10.1016/j.foodpol.2019.101783>
12. Cawley J, Thow AM, Wen K, Frisvold D. The economics of taxes on sugar-sweetened beverages: a review of the effects on prices, sales, cross-border shopping, and consumption. *Annu Rev Nutr* 2019;39(1):317–38. <https://doi.org/10.1146/annurev-nutr-082018-124603>
13. Ng SW, Rivera JA, Popkin BM, Colchero MA. Did high sugar-sweetened beverage purchasers respond differently to the excise tax on sugar-sweetened beverages in Mexico? *Public Health Nutr* 2018 Dec;22(4):1–7.
14. Colchero MA, Rivera-Dommarco J, Popkin BM, Ng SW. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Aff (Millwood)* 2017;36(3):564–71. <https://doi.org/10.1377/hlthaff.2016.1231>
15. Teng AM, Jones AC, Mizdrak A, Signal L, Genç M, Wilson N. Impact of sugar-sweetened beverage taxes on purchases and dietary intake: systematic review and meta-analysis. *Obes Rev* 2019;20(9):1187–204. <https://doi.org/10.1111/obr.12868>
16. Pan American Health Organization. Sugar-sweetened beverage taxation in the Region of the Americas. Washington (DC): Pan American Health Organization; 2020.
17. Lawrence MA, Baker PI. Ultra-processed food and adverse health outcomes. *BMJ* 2019;365:l2289. <https://doi.org/10.1136/bmj.l2289>
18. Rico-Campà A, Martínez-González MA, Alvarez-Alvarez I, de Deus Mendonça R, de la Fuente-Arrillaga C, Gómez-Donoso C, et al. Association between consumption of ultra-processed foods and all cause mortality: SUN prospective cohort study. *BMJ* 2019;365:l1949. <https://doi.org/10.1136/bmj.l1949>
19. Srour B, Fezeu LK, Kesse-Guyot E, Allès B, Méjean C, Andrianasolo RM, et al. Ultra-processed food intake and risk of cardiovascular disease: prospective cohort study (NutriNet-Santé). *BMJ* 2019;365:l1451. <https://doi.org/10.1136/bmj.l1451>
20. Fiolet T, Srour B, Sellem L, Kesse-Guyot E, Allès B, Méjean C, et al. Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort. *BMJ* 2018;360:k322. <https://doi.org/10.1136/bmj.k322>
21. Rauber F, Campagnolo PD, Hoffman DJ, Vitolo MR. Consumption of ultra-processed food products and its effects on children's lipid profiles: a longitudinal study. *Nutr Metab Cardiovasc Dis* 2015;25(1):116–22. <https://doi.org/10.1016/j.numecd.2014.08.001>
22. Mendonça RD, Pimenta AM, Gea A, de la Fuente-Arrillaga C, Martínez-González MA, Lopes AC, et al. Ultraprocessed food consumption and risk of overweight and obesity: the University of Navarra Follow-Up (SUN) cohort study. *Am J Clin Nutr* 2016;104(5):1433–40. <https://doi.org/10.3945/ajcn.116.135004>

23. Adjibade M, Julia C, Allès B, Touvier M, Lemogne C, Srouf B, et al. Prospective association between ultra-processed food consumption and incident depressive symptoms in the French NutriNet-Santé cohort. *BMC Med* 2019;17(1):78. <https://doi.org/10.1186/s12916-019-1312-y>
24. Costa CS, Rauber F, Leffa PS, Sangalli CN, Campagnolo PD, Vitolo MR. Ultra-processed food consumption and its effects on anthropometric and glucose profile: A longitudinal study during childhood. *Nutr Metab Cardiovasc Dis* 2019;29(2):177–84. <https://doi.org/10.1016/j.numecd.2018.11.003>
25. Cunha DB, da Costa TH, da Veiga GV, Pereira RA, Sichieri R. Ultra-processed food consumption and adiposity trajectories in a Brazilian cohort of adolescents: ELANA study. *Nutr Diabetes* 2018;8(1):28. <https://doi.org/10.1038/s41387-018-0043-z>
26. Gómez-Donoso C, Sánchez-Villegas A, Martínez-González MA, Gea A, de Deus Mendonça R, Lahortiga-Ramos F, et al. Ultra-processed food consumption and the incidence of depression in a Mediterranean cohort: the SUN Project. *Eur J Nutr* 2020;59(3):1093–103.
27. Kim H, Hu EA, Rebholz CM. Ultra-processed food intake and mortality in the USA: results from the Third National Health and Nutrition Examination Survey (NHANES III, 1988-1994). *Public Health Nutr* 2019;22(10):1777–85. <https://doi.org/10.1017/S1368980018003890>
28. Mendonça RD, Lopes AC, Pimenta AM, Gea A, Martínez-González MA, Bes-Rastrollo M. Ultra-processed food consumption and the incidence of hypertension in a mediterranean cohort: the Seguimiento Universidad de Navarra Project. *Am J Hypertens* 2017 Apr;30(4):358–66.
29. Rohatgi KW, Tinius RA, Cade WT, Steele EM, Cahill AG, Parra DC. Relationships between consumption of ultra-processed foods, gestational weight gain and neonatal outcomes in a sample of US pregnant women. *PeerJ* 2017;5:e4091. <https://doi.org/10.7717/peerj.4091>
30. Rauber F, da Costa Louzada ML, Steele EM, Millett C, Monteiro CA, Levy RB. Ultra-processed food consumption and chronic non-communicable diseases-related dietary nutrient profile in the UK (2008–2014). *Nutrients* 2018;10(5):587. <https://doi.org/10.3390/nu10050587>
31. Sandoval-Insausti H, Blanco-Rojo R, Graciani A, López-García E, Moreno-Franco B, Laclaustra M, et al. Ultra-processed food consumption and incident frailty: a prospective cohort study of older adults. *J Gerontol A Biol Sci Med Sci* 2020;75(6):1126–33. <https://doi.org/10.1093/gerona/glz140>
32. Schnabel L, Kesse-Guyot E, Allès B, Touvier M, Srouf B, Hercberg S et al. Association between ultraprocessed food consumption and risk of mortality among middle-aged adults in France. *JAMA Intern Med* 2019;179(4):490–8. <https://doi.org/10.1001/jamainternmed.2018.7289>
33. Vandevijvere S, Jaacks LM, Monteiro CA, Moubarac JC, Girling-Butcher M, Lee AC et al. Global trends in ultraprocessed food and drink product sales and their association with adult body mass index trajectories. *Obes Rev* 2019;20(Suppl 2):10–9. <https://doi.org/10.1111/obr.12860>
34. Popkin BM, Reardon T. Obesity and the food system transformation in Latin America. *Obes Rev* 2018;19(8):1028–64. <https://doi.org/10.1111/obr.12694>
35. Cediel G, Reyes M, da Costa Louzada ML, Martínez Steele E, Monteiro CA, Corvalán C et al. Ultra-processed foods and added sugars in the Chilean diet (2010). *Public Health Nutr* 2018;21(1):125–33. <https://doi.org/10.1017/S1368980017001161>
36. Martínez Steele E, Baraldi LG, Louzada ML, Moubarac JC, Mozaffarian D, Monteiro CA. Ultra-processed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study. *BMJ Open* 2016;6(3):e009892. <https://doi.org/10.1136/bmjopen-2015-009892>
37. Moubarac JC, Batal M, Martins AP, Claro R, Levy RB, Cannon G et al. Processed and ultra-processed food products: consumption trends in Canada from 1938 to 2011. *Can J Diet Pract Res* 2014;75(1):15–21. <https://doi.org/10.3148/75.1.2014.15>
38. Canella DS, Levy RB, Martins AP, Claro RM, Moubarac JC, Baraldi LG et al. Ultra-processed food products and obesity in Brazilian households (2008-2009). *PLoS One* 2014;9(3):e92752. <https://doi.org/10.1371/journal.pone.0092752>
39. Monteiro CA, Moubarac JC, Cannon G, Ng SW, Popkin B. Ultra-processed products are becoming dominant in the global food system. *Obes Rev* 2013;14 (Suppl 2):21–8. <https://doi.org/10.1111/obr.12107>
40. Monteiro CA, Levy RB, Claro RM, de Castro IR, Cannon G. Increasing consumption of ultra-processed foods and likely impact on human health: evidence from Brazil. *Public Health Nutr* 2010;14(1):5–13. <https://doi.org/10.1017/S1368980010003241>
41. Pries AM, Rehman AM, Filteau S, Sharma N, Upadhyay A, Ferguson EL. Unhealthy snack food and beverage consumption is associated with lower dietary adequacy and length-for-age z-scores among 12-23-month-olds in Kathmandu Valley, Nepal. *J Nutr* 2019;149(10):1843–51. <https://doi.org/10.1093/jn/nxz140>
42. Pries AM, Filteau S, Ferguson EL. Snack food and beverage consumption and young child nutrition in low- and middle-income countries: A systematic review. *Matern Child Nutr* 2019;15(Suppl 4):e12729. <https://doi.org/10.1111/mcn.12729>
43. Vitta BS, Benjamin M, Pries AM, Champeny M, Zehner E, Huffman SL. Infant and young child feeding practices among children under 2 years of age and maternal exposure to infant and young child feeding messages and promotions in Dar es Salaam, Tanzania. *Matern Child Nutr* 2016;12(Suppl 2):77–90. <https://doi.org/10.1111/mcn.12292>

44. Pries AM, Huffman SL, Mengkheang K, Kroeun H, Champeny M, Roberts M et al. High use of commercial food products among infants and young children and promotions for these products in Cambodia. *Matern Child Nutr* 2016;12(Suppl 2):52–63. <https://doi.org/10.1111/mcn.12270>
45. Pries AM, Huffman SL, Adhikary I, Upreti SR, Dhungel S, Champeny M et al. High consumption of commercial food products among children less than 24 months of age and product promotion in Kathmandu Valley, Nepal. *Matern Child Nutr* 2016;12(Suppl 2):22–37. <https://doi.org/10.1111/mcn.12267>
46. Feeley AB, Ndeye Coly A, Sy Gueye NY, Diop EI, Pries AM, Champeny M et al. Promotion and consumption of commercially produced foods among children: situation analysis in an urban setting in Senegal. *Matern Child Nutr* 2016;12(Suppl 2):64–76. <https://doi.org/10.1111/mcn.12304>
47. Popkin BM, Corvalan C, Grummer-Strawn LM. Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet* 2020;395(10217):65–74.
48. Caro JC, Smith-Taillie L, Ng SW, Popkin BM. Designing a food tax to impact food-related non-communicable diseases: the case of Chile. *Food Policy* 2017;71:86–100. <https://doi.org/10.1016/j.foodpol.2017.08.001>
49. Colchero A, Paraje G, Popkin BM. The impacts on food purchases and tax revenues of a tax based on Chile's nutrient profiling model. 2020. [Unpublished manuscript].
50. Bíró A. Did the junk food tax make the Hungarians eat healthier? *Food Policy* 2015;54:107–15. <https://doi.org/10.1016/j.foodpol.2015.05.003>
51. 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. <https://doi.org/10.1371/journal.pmed.1002057>
52. Taillie LS, Rivera JA, Popkin BM, Batis C. Do high vs. low purchasers respond differently to a nonessential energy-dense food tax? Two-year evaluation of Mexico's 8% nonessential food tax. *Prev Med* 2017;105(Supplement):S37–42. <https://doi.org/10.1016/j.ypmed.2017.07.009>
53. Toews I, Lohner S, Küllenberg de Gaudry D, Sommer H, Meerpohl JJ. Association between intake of non-sugar sweeteners and health outcomes: systematic review and meta-analyses of randomised and non-randomised controlled trials and observational studies. *BMJ* 2019;364:k4718. <https://doi.org/10.1136/bmj.k4718>
54. National Institute of Health Research UK. Evaluation of the health impacts of the UK Treasury Soft Drinks Industry Levy (SDIL). Study number: 16/130/01. 2017.
55. Veerman JL, Sacks G, Antonopoulos N, Martin J. The impact of a tax on sugar-sweetened beverages on health and health care costs: a modelling study. *PLoS One* 2016;11(4):e0151460. <https://doi.org/10.1371/journal.pone.0151460>
56. Manyema M, Veerman LJ, Tugendhaft A, Labadarios D, Hofman KJ. Modelling the potential impact of a sugar-sweetened beverage tax on stroke mortality, costs and health-adjusted life years in South Africa. *BMC Public Health* 2016;16(1):405. <https://doi.org/10.1186/s12889-016-3085-y>
57. Barrientos-Gutierrez T, Zepeda-Tello R, Rodrigues ER, Colchero-Aragónés A, Rojas-Martínez R, Lazcano-Ponce E et al. Expected population weight and diabetes impact of the 1-peso-per-litre tax to sugar sweetened beverages in Mexico. *PLoS One* 2017;12(5):e0176336. <https://doi.org/10.1371/journal.pone.0176336>
58. 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. <https://doi.org/10.1371/journal.pmed.1002158>
59. Grummon AH, Lockwood BB, Taubinsky D, Allcott H. Designing better sugary drink taxes. *Science* 2019;365(6457):989–90. <https://doi.org/10.1126/science.aav5199>
60. Caro JC, Corvalán C, Reyes M, Silva A, Popkin B, Taillie LS. Chile's 2014 sugar-sweetened beverage tax and changes in prices and purchases of sugar-sweetened beverages: an observational study in an urban environment. *PLoS Med* 2018;15(7):e1002597. <https://doi.org/10.1371/journal.pmed.1002597>
61. Glauber JW, Sumner DA, Wilde PE. Poverty, hunger, and US agricultural policy: do farm programs affect the nutrition of poor Americans? *AEI Paper & Studies*; 2017.
62. Lee Y, Mozaffarian D, Sy S, Huang Y, Liu J, Wilde PE, et al. Cost-effectiveness of financial incentives for improving diet and health through Medicare and Medicaid: a microsimulation study. *PLoS Med* 2019;16(3):e1002761-e. <https://doi.org/10.1371/journal.pmed.1002761>
63. Niebylski ML, Redburn KA, Duhaney T, Campbell NR. Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence. *Nutrition* 2015;31(6):787–95. <https://doi.org/10.1016/j.nut.2014.12.010>
64. Scarborough P, Adhikari V, Harrington RA, Elhussein A, Briggs A, Rayner M et al. Impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size and number of available soft drinks in the UK, 2015-19: A controlled interrupted time series analysis. *PLoS Med* 2020;17(2):e1003025. <https://doi.org/10.1371/journal.pmed.1003025>
65. Goiana-da-Silva F, Cruz-E-Silva D, Gregório MJ, Miraldo M, Darzi A, Araújo F. The future of the sweetened beverages tax in Portugal. *Lancet Public Health* 2018;3(12):e562. [https://doi.org/10.1016/S2468-2667\(18\)30240-8](https://doi.org/10.1016/S2468-2667(18)30240-8)



66. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F et al. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr* 2019;22(5):936–41. <https://doi.org/10.1017/S1368980018003762>
67. Alvarado M, Unwin N, Sharp SJ, Hambleton I, Murphy MM, Samuels TA et al. Assessing the impact of the Barbados sugar-sweetened beverage tax on beverage sales: an observational study. *Int J Behav Nutr Phys Act* 2019;16(1):13. <https://doi.org/10.1186/s12966-019-0776-7>
68. Sugary Drink Tax Equity Workgroup. Centering equity in sugary drink tax policy: research agenda. Healthy Food America and The Praxis Project. 2020. <https://www.healthyfoodamerica.org/sugary-drink-tax-equity>
69. 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. <https://doi.org/10.1371/journal.pmed.1002158>
70. The World Bank. Curbing the epidemic: governments and the economics of tobacco control. *Tob Control* 1999;8(2):196–201. <https://doi.org/10.1136/tc.8.2.196>
71. World Health Organization. WHO report on the global tobacco epidemic, 2017: monitoring tobacco use and prevention policies. Geneva (Switzerland): World Health Organization; 2017.
72. Palmedo PC, Dorfman L, Garza S, Murphy E, Freudenberg N. Countermarketing alcohol and unhealthy food: an effective strategy for preventing noncommunicable diseases? Lessons from tobacco. *Annu Rev Public Health* 2017;38(1):119–44. <https://doi.org/10.1146/annurev-publhealth-031816-044303>
73. Dertwinkel-Kalt M. Salience and health campaigns. *Forum Health Econ Policy* 2016;19(1):1.
74. Krieger J, Bleich SN, Scarmo S, Ng SW. Sugar-sweetened beverage reduction policies: progress and promise. *Annu Rev Public Health* 2020;42:439–61.
75. Pomeranz JL, Zellers L, Bare M, Pertschuk M. State preemption of food and nutrition policies and litigation: undermining government's role in public health. *Am J Prev Med* 2019;56(1):47–57. <https://doi.org/10.1016/j.amepre.2018.07.027>
76. Crosbie E, Pomeranz JL, Wright KE, Hoepfer S, Schmidt L. State preemption: an emerging threat to local sugar-sweetened beverage taxation. *Am J Public Health* 2021;111(4):677–86. <https://doi.org/10.2105/AJPH.2020.306062>
77. Bennet S, Draper N, Farnsworth I, McBride F. The Bay Area sugar-sweetened beverage taxes: an evaluation of community investments. Praxis Project and the Berkeley Food Institute; 2019.
78. Healthy Food America. Healthy food pricing incentives: designing successful programs. Seattle (WA): Healthy Food America; 2019.
79. Department of Prevention of Noncommunicable Diseases, World Health Organization. Taxes on sugary drink, why do it? 2017. <https://apps.who.int/iris/bitstream/handle/10665/260253/WHO-NMH-PND-16.5Rev.1-eng.pdf?sequence=1>
80. World Health Organization. UN OneHealth costing tool. <https://www.who.int/choice/onehealthtool/en/>

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**Table A.1. Select examples of unhealthy beverage and food taxes (collected from distributors, manufacturers, or importers) and findings to date**

Examples of sites with excise taxes	Brief description of tax	Price change	Volume sales or purchases change of taxed products	Intake change of taxed products	Other changes	Revenue use	Other gaps in knowledge
<b>Berkeley, CA</b> (since March 2015)	1 cent/oz excise tax <sup>a</sup> on SSBs	↑ <sup>b-d</sup>	↓ <sup>b</sup>	↔ <sup>b</sup> ↓ <sup>e,f</sup>	↔ Un/employment	Determined by committee/ advisory board <sup>g</sup>	Small geographical area (partially addressed by SSB taxes implemented in neighboring localities); relatively low baseline levels of SSB consumption
<b>Oakland, CA</b> (since July 2017)	1 cent/oz excise tax on SSBs	↑ <sup>h,i</sup> ↔ <sup>i</sup>	↔ <sup>h</sup>	↔ <sup>h</sup>	↓ Price promotions <sup>j</sup>	Determined by committee/ advisory board <sup>g</sup>	
<b>Seattle, WA</b> (since Jan 2018)	1.75 cent/oz excise tax on SSBs	↑ <sup>k</sup>	↓ <sup>k</sup>	TBD	TBD	Determined by Community Advisory Board 2020: \$3 million for fruit & vegetable vouchers; \$6 million for COVID-19 grocery vouchers <sup>l</sup>	Some indication of cross-border shopping
<b>Philadelphia, PA</b> (since Jan 2017)	1.5 cent/oz excise tax on both SSBs and artificially sweetened beverages	↑ <sup>m</sup>	↓ <sup>m,n</sup>	↓/↔ <sup>n</sup> ↓/↔ <sup>o,p</sup>	↔ Employment <sup>q,r</sup>	Office of Education (early childhood education slots) and general budget <sup>s</sup>	Some indication of cross-border shopping
<b>Mexico</b> (since Jan 2014)	1 peso/liter excise tax on SSBs	↑ <sup>t</sup>	↓ <sup>u-x</sup>	↓ <sup>y</sup>	↔ un/employment <sup>z</sup> ↓ (modeled) NCDs, mortality and healthcare costs <sup>aa,bb</sup>	General budget	Manufacturer response in terms of reformulations
	8% excise tax on non-essential foods with >275 kcals/100 g		↑ <sup>cc</sup>		↔ Un/employment <sup>z</sup>	General budget	Manufacturer response in terms of reformulations
<b>United Kingdom</b> (since April 2018)	18 pence/liter for low sugar (5–8 g sugar); 24 pence/liter for high sugar (>8 g sugar) among SSBs; excise tax	↑ <sup>dd</sup>	↓	TBD	↔ Sugar <sup>ee</sup> ↓ Sugar content ↓ High sugar product availability ↓ Product size (store brands) <sup>dd</sup> ↔ Stock market value <sup>ff</sup>	General budget	Impact of reformulations with artificial sweeteners unknown
<b>South Africa</b> (since April 2018)	0.021 ZAR/gram of sugar in 100 mL of ready-to-drink SSBs above 4 g sugar excise tax	↑ <sup>gg</sup>	↓ <sup>hh</sup>	↓ <sup>ii</sup>	↓ Sugar and calories <sup>hh,ii</sup>	General budget (small % given to Dept. of Health)	Impact of reformulations with artificial sweeteners unknown

(continued)

**Table A.1. Select examples of unhealthy beverage and food taxes (collected from distributors, manufacturers, or importers) and findings to date (continued)**

Examples of sites with excise taxes	Brief description of tax	Price change	Volume sales or purchases change of taxed products	Intake change of taxed products	Other changes	Revenue use	Other gaps in knowledge
<b>Saudi Arabia</b> (since June 2017)	50% excise tax on carbonated beverages	↑ <sup>jj</sup>	↓ <sup>jj</sup>			General budget <sup>kk</sup>	
<b>India</b> (since July 2017)	40% sales tax <sup>ll</sup> on aerated drinks and lemonades collected at point of sale to consumers		↔ <sup>mm</sup>			General budget	
<b>Hungary</b> (since September 2011)	Excise taxes for different unhealthy beverages and foods: <ul style="list-style-type: none"> <li>• Soft drinks: 7 forints/liter, concentrated syrups: 200 forints/liter, and pre-packaged sugar-sweetened products: 130 forints/kg</li> <li>• Products with &gt;1 g salt/100 g, condiments with &gt;5 g salt/100 g, flavorings with &gt;15 g salt/100 g: 100 forints/kg</li> </ul>		↓ <sup>nn</sup>	↓ <sup>oo</sup>	↓ Sugar content, ↓ Sodium content <sup>oo</sup>	Increased wages of healthcare workers <sup>oo</sup>	Impact of reformulations with artificial sweeteners unknown

Notes: ↓ = decrease; ↔ = no effect; ↑ = increase; SSB = sugar-sweetened beverage; TBD = to be determined from ongoing research studies.

- a Excise taxes are levied on and collected from manufacturers/distributors/importers.
- b Silver LD, Ng SW, Ryan-Ibarra S, Taillie LS, Induni M, Miles DR et al. Changes in prices, sales, consumer spending, and beverage consumption one year after a tax on sugar-sweetened beverages in Berkeley, California, US: A before-and-after study. *PLoS Med* 2017;14(4):e1002283. <https://doi.org/10.1371/journal.pmed.1002283>
- c Falbe J, Rojas N, Grummon AH, Madsen KA. Higher retail prices of sugar-sweetened beverages 3 months after implementation of an excise tax in Berkeley, California. *Am J Public Health* 2015;105(11):2194–201. <https://doi.org/10.2105/AJPH.2015.302881>
- d Cawley J, Frisvold DE. The pass-through of taxes on sugar-sweetened beverages to retail prices: the case of Berkeley, California. *J Policy Anal Manage* 2017;36(2):303–26. <https://doi.org/10.1002/pam.21960>
- e 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. <https://doi.org/10.2105/AJPH.2016.303362>
- f Lee MM, Falbe J, Schillinger D, Basu S, McCulloch CE, Madsen KA. Sugar-sweetened beverage consumption 3 years after the Berkeley, California, sugar-sweetened beverage tax. *Am J Public Health* 2019;109(4):637–9. <https://doi.org/10.2105/AJPH.2019.304971>
- g Bennet S, Draper N, Farnsworth I, McBride F. The Bay Area sugar-sweetened beverage taxes: an evaluation of community investments. *Praxis Project and the Berkeley Food Institute*; 2019.
- h Cawley J, Frisvold D, Hill A, Jones D. Oakland's sugar-sweetened beverage tax: impacts on prices, purchases and consumption by adults and children. *Econ Hum Biol* 2020;37:100865. <https://doi.org/10.1016/j.ehb.2020.100865>
- i Marinello S, Pipito AA, Leider J, Pugach O, Powell LM. The impact of the Oakland sugar-sweetened beverage tax on bottled soda and fountain drink prices in fast-food restaurants. *Prev Med Rep* 2019;17:101034. <https://doi.org/10.1016/j.pmedr.2019.101034>
- j Zenk SN, Leider J, Pugach O, Pipito AA, Powell LM. Changes in beverage marketing at stores following the Oakland sugar-sweetened beverage tax. *Am J Prev Med* 2020;58(5):648–56. <https://doi.org/10.1016/j.amepre.2019.12.014>
- k Powell LM, Leider J. The impact of Seattle's Sweetened Beverage Tax on beverage prices and volume sold. *Econ Hum Biol* 2020;37:100856. <https://doi.org/10.1016/j.ehb.2020.100856>
- l Scruggs G. Seattle turns soda tax revenue into emergency grocery vouchers during pandemic. *Next City*. 2020 Mar;2020:30.
- m Roberto CA, Lawman HG, LeVasseur MT, Mitra N, Peterhans A, Herring B et al. Association of a beverage tax on sugar-sweetened and artificially sweetened beverages with changes in beverage prices and sales at chain retailers in a large urban setting. *JAMA* 2019;321(18):1799–810. <https://doi.org/10.1001/jama.2019.4249>
- n Cawley J, Frisvold D, Hill A, Jones D. The impact of the Philadelphia beverage tax on purchases and consumption by adults and children. *J Health Econ* 2019;67:102225. <https://doi.org/10.1016/j.jhealeco.2019.102225>
- o Zhong Y, Auchincloss AH, Lee BK, Kanter GP. The short-term impacts of the Philadelphia beverage tax on beverage consumption. *Am J Prev Med* 2018;55(1):26–34. <https://doi.org/10.1016/j.amepre.2018.02.017>
- p Zhong Y, Auchincloss AH, Lee BK, McKenna RM, Langellier BA. Sugar-sweetened and diet beverage consumption in Philadelphia one year after the beverage tax. *Int J Environ Res Public Health* 2020;17(4):1336. <https://doi.org/10.3390/ijerph17041336>
- q Office of the Mayor, Department of Revenue. Data Released Demonstrating Strong Employment in Sectors Affected by PBT. 2018 Apr 11 [cited 2018 Apr 20]. <https://beta.phila.gov/2018-04-11-data-released-demonstrating-strong-employment-in-sectors-affected-by-pbt/>
- r Lawman HG, Bleich SN, Yan J, LeVasseur MT, Mitra N, Roberto CA. Unemployment claims in Philadelphia one year after implementation of the sweetened beverage tax. *PLoS One* 2019;14(3):e0213218. <https://doi.org/10.1371/journal.pone.0213218>
- s Data Release: Beverage Tax Revenue and Expenditures. 2019. <https://controller.phila.gov/philadelphia-audits/data-release-beverage-tax/>

(table footnotes continued)

**Table A.1. Select examples of unhealthy beverage and food taxes (collected from distributors, manufacturers, or importers) and findings to date** *(footnotes continued)*

- <sup>t</sup> 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. <https://doi.org/10.1371/journal.pone.0144408>
- <sup>u</sup> Ng SW, Rivera JA, Popkin BM, Colchero MA. Did high sugar-sweetened beverage purchasers respond differently to the excise tax on sugar-sweetened beverages in Mexico? *Public Health Nutr* 2018 Dec;22(4):1–7.
- <sup>v</sup> 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. <https://doi.org/10.1371/journal.pone.0163463>
- <sup>w</sup> 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. <https://doi.org/10.1136/bmj.h6704>
- <sup>x</sup> Colchero MA, Rivera-Dommarco J, Popkin BM, Ng SW. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Aff (Millwood)* 2017;36(3):564–71. <https://doi.org/10.1377/hlthaff.2016.1231>
- <sup>y</sup> Sánchez-Romero LM, Canto-Osorio F, González-Morales R, Colchero MA, Ng SW, Ramírez-Palacios P et al. Association between tax on sugar sweetened beverages and soft drink consumption in adults in Mexico: open cohort longitudinal analysis of Health Workers Cohort Study. *BMJ* 2020;369:m1311. <https://doi.org/10.1136/bmj.m1311>
- <sup>z</sup> Guerrero-López CM, Molina M, Colchero MA. Employment changes associated with the introduction of taxes on sugar-sweetened beverages and nonessential energy-dense food in Mexico. *Prev Med* 2017;105(Supplement):S43–9. <https://doi.org/10.1016/j.ypmed.2017.09.001>
- <sup>aa</sup> Barrientos-Gutiérrez T, Zepeda-Tello R, Rodríguez ER, Colchero-Aragónés A, Rojas-Martínez R, Lazcano-Ponce E et al. Expected population weight and diabetes impact of the 1-peso-per-litre tax to sugar sweetened beverages in Mexico. *PLoS One* 2017;12(5):e0176336.
- <sup>bb</sup> 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. <https://doi.org/10.1371/journal.pmed.1002158>
- <sup>cc</sup> 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. <https://doi.org/10.1371/journal.pmed.1002057>
- <sup>dd</sup> Scarborough P, Adhikari V, Harrington RA, Elhussein A, Briggs A, Rayner M et al. Impact of the announcement and implementation of the UK Soft Drinks Industry Levy on sugar content, price, product size and number of available soft drinks in the UK, 2015–19: A controlled interrupted time series analysis. *PLoS Med* 2020;17(2):e1003025. <https://doi.org/10.1371/journal.pmed.1003025>
- <sup>ee</sup> Bandy LK, Scarborough P, Harrington RA, Rayner M, Jebb SA. Reductions in sugar sales from soft drinks in the UK from 2015 to 2018. *BMC Med* 2020;18(1):20. <https://doi.org/10.1186/s12916-019-1477-4>
- <sup>ff</sup> Law C, Cornelsen L, Adams J, Penney T, Rutter H, White M et al. An analysis of the stock market reaction to the announcements of the UK Soft Drinks Industry Levy. *Econ Hum Biol* 2020;38:100834. <https://doi.org/10.1016/j.ehb.2019.100834>
- <sup>gg</sup> Stacey N, Mudara C, Ng SW, van Walbeek C, Hofman K, Edoka I. Sugar-based beverage taxes and beverage prices: Evidence from South Africa's Health Promotion Levy. *Soc Sci Med* 2019;238:112465. <https://doi.org/10.1016/j.socscimed.2019.112465>
- <sup>hh</sup> Stacey N, Edoka I, Hofman K, Swart R, Popkin B, Ng SW. Changes in beverage purchases following the announcement and implementation of South Africa's Health Promotion Levy: an observational study. *Lancet Planetary Health* 5(4):E200–8. [https://doi.org/10.1016/S2542-5196\(20\)30304-1](https://doi.org/10.1016/S2542-5196(20)30304-1)
- <sup>ii</sup> Essman M, Taillie L, Ng S, Popkin B, Jenkins T, Swart R. Taxed and untaxed beverage consumption by young adults in Langa, South Africa before and one year after a national sugar-sweetened beverage tax. *PLoS Med* 2021;18(5):e1003574. <https://doi.org/10.1371/journal.pmed.1003574>
- <sup>jj</sup> Alsukait R, Wilde P, Bleich SN, Singh G, Folta SC. Evaluating Saudi Arabia's 50% carbonated drink excise tax: changes in prices and volume sales. *Econ Hum Biol* 2020;38:100868. <https://doi.org/10.1016/j.ehb.2020.100868>
- <sup>kk</sup> Alsukait R, Bleich S, Wilde P, Singh G, Folta S. Sugary drink excise tax policy process and implementation: case study from Saudi Arabia. *Food Policy* 2020;90:101789. <https://doi.org/10.1016/j.foodpol.2019.101789>
- <sup>ll</sup> Sales taxes are collected at point of sale from shoppers.
- <sup>mmm</sup> Law C, Brown KA, Green R, Venkateshmurthy NS, Mohan S, Scheelbeek PFD, et al. Changes in take-home aerated soft drink purchases in urban India after the implementation of Goods and Services Tax (GST): an interrupted time series analysis. *SSM Pop Health* 2021;14:100794. <https://doi.org/10.1016/j.ssmph.2021.100794>
- <sup>nn</sup> Bíró A. Did the junk food tax make the Hungarians eat healthier? *Food Policy* 2015;54:107–15.
- <sup>oo</sup> World Health Organization–Europe. Assessment of the impact of a public health product tax. Geneva (Switzerland): WHO; 2015.