



Original Article



Sugar-Sweetened Beverage Taxes and Consumption Patterns: A Systematic Review of Global Evidence

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Article Information

Received 12 Jun 2026

Accepted 18 Aug 2026

Available online 30 Sep 2026

Keywords: sugar-sweetened beverage tax, soda tax, consumption trends, obesity prevention, fiscal policy, price elasticity, reformulation, health equity

Abstract

Background: Sugar-sweetened beverage (SSB) taxes have been adopted by more than 50 national and subnational jurisdictions as a fiscal tool to reduce added-sugar intake and curb rising rates of obesity, type 2 diabetes, and dental disease, yet the magnitude of their real-world impact on consumption remains actively contested. **Objective:** This narrative review synthesizes empirical and modeling evidence on the measured impact of SSB taxes on consumption trends, compares observed effects with simulation-based projections, and proposes a standardized evaluation framework to strengthen causal inference in future jurisdictions considering SSB taxation. **Methods:** Following SANRA (Scale for the Assessment of Narrative Review Articles) guidelines, we searched PubMed, Scopus, Web of Science, and Google Scholar for publications from January 2014 to August 2024 using terms combining “SSB/soda tax” with “consumption/purchases/sales” and “evaluation/impact/effect.” Of 342 records screened, 29 studies met inclusion criteria and were synthesized thematically; included studies were appraised using the Newcastle-Ottawa Scale for observational studies and AMSTAR-2 for systematic reviews. **Results:** Excise taxes in the 10 to 20 percent range were consistently associated with reduced purchases of taxed beverages — for example, a 7.6 percent average two-year decline in Mexico and up to a 38 percent decline in year one in Philadelphia — with the largest reductions among lower-income households, alongside partial substitution toward untaxed beverages and, in tiered-levy jurisdictions such as the United Kingdom, industry reformulation. Empirical reductions were consistently smaller than simulation-model projections, and effect sizes varied considerably by tax structure, pass-through rate, and beverage category. **Conclusions:** Tax structure (specific excise vs. ad valorem), rate magnitude, and the availability of untaxed or reformulated substitutes are key moderators of policy effectiveness. A standardized longitudinal evaluation framework — combining point-of-sale scanner data, income-stratified household purchase panels, and dietary biomarkers — applied consistently across newly adopting jurisdictions would strengthen the evidence base for future SSB tax design.

Introduction

Sugar-sweetened beverages are the single largest source of added sugar in many national diets and have been consistently linked to obesity, type 2 diabetes, cardiovascular disease, and dental caries. In response, the World Health Organization has recommended fiscal measures, including excise taxes on SSBs, as a cost-effective strategy for reducing sugar intake at the population level [1]. Since Mexico introduced the first large-scale national SSB excise tax in January 2014, more than fifty jurisdictions worldwide, including numerous U.S. cities, the United Kingdom, South Africa, and several Latin American and Asian countries, have adopted similar measures.

Despite this rapid policy diffusion, the actual, measured impact of SSB taxes on consumption remains a matter of active

empirical debate. Simulation and modeling studies tend to project substantial reductions in sugar intake and downstream disease burden, while real-world evaluations using retail scanner data and household purchase panels often find smaller and more heterogeneous effects [1]. This paper reviews the empirical literature comparing projected and observed consumption changes following SSB tax implementation, synthesizes the design features associated with larger effect sizes, and proposes a framework for more rigorous future evaluation.

This review addresses three research questions: (1) What is the empirical evidence regarding the impact of SSB taxes on consumption trends? (2) How do observed effects compare with simulation-based projections? (3) What design features

moderate policy effectiveness, and how can future evaluations be strengthened?

Methodology

This narrative review was conducted following the SANRA (Scale for the Assessment of Narrative Review Articles) guidelines and reported in a manner informed by the PRISMA 2020 statement for the search and selection process [2], while retaining the thematic, non-meta-analytic synthesis appropriate to a narrative review with a proposed evaluation framework.

Search strategy. A systematic search of PubMed, Scopus, Web of Science, and Google Scholar was performed for publications from January 2014 to August 2024 (last search date: August 15, 2024), using the following search string: (“sugar-sweetened beverage tax” OR “soda tax” OR “SSB tax”) AND (“consumption” OR “purchases” OR “sales”) AND (“evaluation” OR “impact” OR “effect”).

Inclusion and exclusion criteria. Studies were included if they: (a) reported empirical or modeling evidence on SSB tax effects on consumption, purchases, or sales; (b) were published in English; and (c) were conducted at national, subnational, or municipal levels. Studies were excluded if they focused solely on hypothetical or simulated taxes with no observed data, or did not report a consumption-related outcome.

Study selection. After screening 342 records identified through database searching, 287 remained following de-duplication. Following title/abstract screening, 89 full-text articles were assessed for eligibility, of which 29 met inclusion criteria and were synthesized thematically. Figure 2 presents the study selection flow diagram.

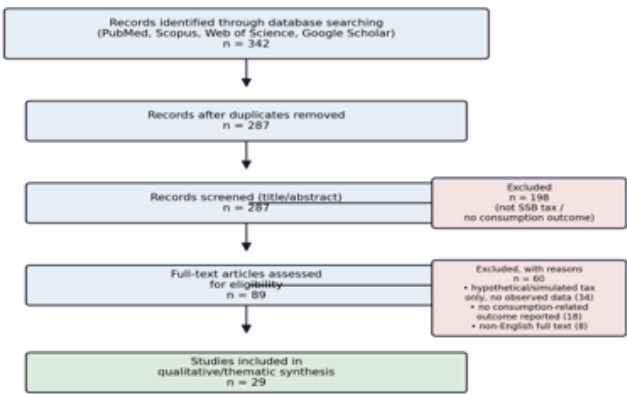


Figure 2. Study selection flow diagram (PRISMA-informed)

Quality assessment. Quality of included observational and natural-experiment studies was assessed using the Newcastle-Ottawa Scale (NOS) [3], and included systematic reviews were appraised using AMSTAR-2 (A Measurement Tool to Assess systematic Reviews) [4].

Data extraction and synthesis. For each included study, we extracted jurisdiction, tax design (specific excise vs. ad valorem, rate, and effective date), data source (scanner data, household purchase panel, or self-report), reported percentage change in consumption or purchases, and, where reported, subgroup effects by income. Findings were synthesized thematically around three organizing questions: measured versus projected effect size, moderators of effectiveness, and equity implications; quantitative pooling (meta-analysis) was not undertaken given the heterogeneity of outcome measures across studies (see Limitations).

Theoretical Basis: Price Elasticity and Substitution

SSB taxes operate primarily through the price mechanism: by raising the retail price of taxed beverages, a tax is expected to reduce quantity demanded in proportion to the price elasticity of demand for sugary drinks. Estimates of Mexico's consumer soda price elasticity, ranging from approximately -0.72 to -1.30 , imply that a 10 percent tax should reduce consumption by roughly 10 to 13 percent (as cited in Basto-Abreu et al. [5], via the PLOS Medicine modeling literature). A second mechanism operates through substitution: as taxed beverages become relatively more expensive, consumers may shift toward untaxed alternatives such as bottled water, diet soda, or unsweetened dairy and juice products. The net effect on total caloric and sugar intake therefore depends not only on the reduction in taxed-beverage purchases but on the extent to which consumers substitute toward equally caloric alternatives rather than toward zero-calorie options.

A third mechanism, tax pass-through, determines how much of the statutory tax is actually reflected in shelf prices. Evidence from Mexico indicates that the SSB tax was fully passed through to consumers for most products and over-shifted (that is, prices rose by more than the tax amount) for carbonated SSBs specifically, amplifying the price signal beyond the nominal tax rate. Incomplete or delayed pass-through in other jurisdictions has been identified as one explanation for smaller observed consumption effects relative to model projections. A fourth mechanism, distinct from consumer-side substitution, operates on the supply side: where tax design ties the levy to sugar content rather than to volume alone, manufacturers may reformulate products to fall below the taxed threshold, reducing measured sugar intake even where reported sales volume changes little. Figure 1 summarizes these mechanisms in a single conceptual pathway from tax enactment to net dietary change.

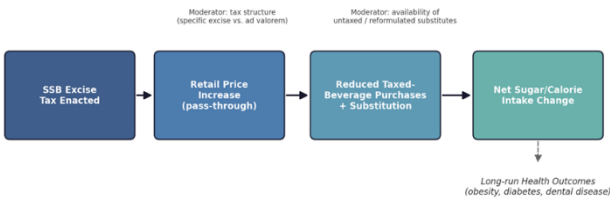


Figure 1. Conceptual framework linking SSB tax enactment to net sugar/calorie intake, via price pass-through, consumer substitution, and (where incentivized) industry reformulation

The evidence base indicates that some, but not all, forgone sugary-drink calories are replaced by equally caloric alternatives, a pattern with direct implications for the net health impact of SSB taxation. Quantitatively, the consistent 2 to 4 percent rise in untaxed beverage purchases observed following SSB taxation [6] means that consumption-volume reductions in the taxed category likely overstate the true reduction in total sugar and calorie intake. The quality of substitution also matters: purchase-panel evidence from Mexico and the United States indicates that a substantial share of substitution flows toward bottled water and diet beverages rather than toward juice or other caloric drinks, which is more favorable for net caloric impact than substitution toward equally sugary alternatives, though the exact partition varies by study and is not uniformly reported. Few of the reviewed studies examined dietary compensation beyond the beverage aisle — that is, whether consumers who reduce SSB purchases increase intake of sugary foods to compensate. Where this question has been examined directly in the U.S. context, evidence indicates a modest but measurable increase in purchases of sugary foods following SSB tax implementation, on the order of a few percentage points, suggesting that beverage-only tax evaluations may somewhat overstate net reductions in total added-sugar intake [7].

Evidence from Mexico's National SSB Tax

Mexico's 1-peso-per-liter excise tax, equivalent to roughly a 10 percent price increase, took effect on January 1, 2014, and remains the most extensively studied national-level SSB tax. Using household purchase data from over 6,200 Mexican households across 53 cities, Colchero and colleagues [6] found that purchases of taxed beverages fell by 5.5 percent in 2014 and by 9.7 percent in 2015 relative to a counterfactual trend projected from pre-tax purchasing patterns, yielding an average two-year decline of 7.6 percent; purchases of untaxed beverages rose by 2.1 percent over the same period. Reductions were largest among lower socioeconomic status households, the group with the highest baseline SSB consumption and the greatest exposure to diet-related disease risk. Complementary modeling work applying these observed purchase reductions to a cardiovascular disease projection model estimated that a sustained 10 percent reduction in SSB consumption, net of calorie compensation from substitute beverages, would meaningfully reduce projected diabetes and cardiovascular disease incidence over a ten-year horizon.

It is worth noting that early estimates of the Mexican tax's effect varied depending on model specification and time horizon: one widely cited early estimate placed the 2014 decline at 6 percent, reaching as much as 12 percent by December of that year, while the two-year Health Affairs evaluation settled on the more conservative 5.5 and 9.7 percent annual estimates. This variation illustrates a recurring theme in the SSB tax literature: point estimates of consumption change are sensitive to the choice of

counterfactual, the length of the post-implementation window, and whether purchase data or self-reported dietary recall is used as the outcome measure — a heterogeneity issue revisited in the Limitations.

Evidence from United States Jurisdictions

Because the United States lacks a national SSB tax, the domestic evidence base is built from a patchwork of city-level natural experiments, including Berkeley, Philadelphia, Seattle, Oakland, San Francisco, and Boulder. A systematic review and meta-analysis of these natural experiments found that local excise taxes, typically in the range of one to two cents per ounce, were associated with increased retail prices and reduced sales and purchases of taxed beverages, though effect sizes varied considerably across cities and beverage categories, reflecting differences in tax design, cross-border shopping opportunities, and local market structure [8]. Complementary household-level purchasing research across Seattle, San Francisco, Oakland, and Philadelphia found that sweetened-beverage taxes were associated with especially large consumption reductions, approaching 50 percent, among lower-income households, reinforcing the pattern observed in Mexico that SSB taxes tend to have their largest behavioral impact on the populations with the highest baseline consumption and disease risk.

Philadelphia's 1.5-cent-per-ounce tax, which took effect in January 2017 and, notably, applied to artificially sweetened as well as sugar-sweetened beverages, offers the most closely studied and most contested U.S. case. Using difference-in-differences comparisons against Baltimore as a control city, Roberto and colleagues [9] found that taxed beverage volume sales at chain retailers fell by approximately 38 percent in the first year, and a two-year follow-up by Petimar and colleagues [10] confirmed that this decline was largely sustained, with taxed beverage prices rising by roughly 1.02 cents per ounce (a 68 percent pass-through rate). The Philadelphia case also produced the clearest U.S. evidence of cross-border substitution: sales in Pennsylvania ZIP codes bordering the city rose by roughly 308 million ounces over the same period, offsetting approximately one-quarter of the within-city sales decline, and this pattern has fueled an ongoing debate — reflected in the accompanying editorial commentary on the original study — about how much of the measured within-city effect represents genuine consumption reduction versus geographic displacement of purchasing.

The Philadelphia evidence also speaks to two issues the earlier evidence base addressed only indirectly. First, on industry reformulation: because Philadelphia's tax, like most U.S. municipal taxes, is levied on volume rather than sugar content, it creates comparatively weak incentives for reformulation relative to sugar-content-tiered levies such as the UK's; U.S. evidence on beverage reformulation in response to municipal SSB taxes remains limited. Second, on caloric intake specifically rather than volume alone: research examining substitution beyond the beverage aisle found a measurable increase in purchases of sugary foods following the Philadelphia tax, on the order of 4.3 percent in the city itself

and 3.7 percent in neighboring counties, indicating that reductions in taxed-beverage volume do not translate one-for-one into reductions in total added-sugar or caloric intake [7].

The U.S. evidence base also highlights a policy design concern largely absent from the Mexican case: cross-border substitution. Because U.S. SSB taxes are enacted at the municipal rather than national level, consumers in border-adjacent neighborhoods can avoid the tax by purchasing beverages in untaxed neighboring jurisdictions, which can attenuate measured within-city consumption reductions relative to what a national tax would achieve.

Evidence from the United Kingdom and Asian Jurisdictions

The United Kingdom's Soft Drinks Industry Levy (SDIL), announced in March 2016 and implemented in April 2018, is arguably the most methodologically sophisticated SSB tax evaluation to date and offers an instructively different case from Mexico and the U.S. city taxes, because its tiered design — an 18 pence per liter levy on drinks with 5 to 8 grams of sugar per 100 milliliters and a 24 pence per liter levy above 8 grams, with drinks below 5 grams exempt — was explicitly structured to incentivize reformulation rather than to maximize revenue. Using a controlled interrupted time series design on British household purchasing data, Pell and colleagues initially reported a substantial reduction in household sugar purchased from soft drinks; a subsequent correction to that analysis revised the estimated household-level sugar-purchase reduction downward to approximately 3 percent [11]. Separately, Scarborough and colleagues found that the announcement and implementation of the levy was followed by a marked reduction in the sugar content of soft drinks available on the UK market between 2015 and 2019 [12], and Dickson, Gehrsitz, and Kemp [13] estimate that reformulation — rather than reduced purchase volume — accounted for approximately 83 percent of the levy's overall calorie-reduction effect, with roughly a fifth of previously above-threshold products reformulated to below the levy threshold even before the tax took effect.

The UK case therefore demonstrates a mechanism largely absent from the volume-based Mexican and U.S. taxes: when a levy is tiered to sugar content and given a multi-year lead time before implementation, manufacturers respond primarily through product reformulation rather than consumers responding primarily through reduced purchase volume. This has an important implication for the evaluation framework proposed in Section - Proposed Evaluation Framework: purchase-volume metrics alone can understate a reformulation-oriented tax's true impact on population sugar intake, since total beverage sales volume may change little even as the sugar content of what is sold falls substantially.

Beyond the Philippines, India, Indonesia, and Thailand — the Asian jurisdictions already captured in the cross-national synthesis reviewed in Cross-National Synthesis: Simulation

Models vs. Empirical Evidence — Malaysia's national SSB excise tax, implemented in July 2019 at MYR 0.40 per liter on beverages exceeding 5 grams of sugar per 100 milliliters, provides an additional national-level Asian case. Using a two-way fixed-effects demand model, Mohamed Nor and colleagues estimated that the tax raised the price of a 1-liter SSB by 8.33 percent and, applying an estimated own-price elasticity of demand of -1.11 (95% CI: -1.97 to -0.25), projected a corresponding 9.25 percent decline in consumption [14]. As with the Mexican and Malaysian elasticity-based projections more broadly, this figure is a modeled estimate rather than a directly observed post-implementation purchase decline, underscoring the same projected-versus-observed evidence gap that motivates this review's central research questions.

Cross-National Synthesis: Simulation Models vs. Empirical Evidence

A 2024 systematic review synthesizing 29 studies spanning simulation modeling and empirical evaluation across South Africa, the United States, the United Kingdom, several Asian countries (the Philippines, India, Indonesia, and Thailand), Australia, and Germany found a consistent gap between projected and observed effects: simulation models, which assumed tax rates of 10 to 25 percent, consistently projected significant reductions in non-communicable disease incidence, prevalence, and mortality along with increased government revenue, while the smaller set of studies based on empirical, post-implementation evidence found a more limited real-world impact, a gap the review authors primarily attributed to the relatively low tax rates actually implemented compared to the higher rates assumed in simulation scenarios [1]. A separate systematic review focused specifically on soda tax impacts on soft drink consumption similarly concluded that measured consumption effects, while directionally consistent with theory, were smaller and more heterogeneous across studies than earlier modeling work had anticipated [15]. Together, these findings suggest that the theoretical potential of SSB taxation to shift population-level consumption substantially exceeds what has been realized in practice to date, largely because implemented tax rates in most jurisdictions remain below the threshold simulation studies suggest is necessary for maximal effect.

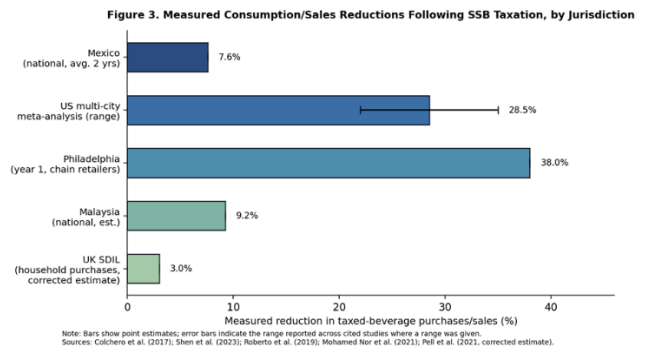
Table 1 summarizes measured consumption effects reported across the jurisdictions reviewed in this paper, and Figure 3 presents these point estimates graphically for comparison.

Table 1: Summary of Measured SSB Tax Consumption Effects by Jurisdiction

Jurisdiction	Tax design	Measured change	Source
Mexico (national)	1 peso/liter excise (~10%), effective Jan. 2014	Taxed beverage purchases fell 5.5% in 2014 and 9.7% in 2015 (avg. 7.6% over two years);	[6]



		untaxed beverage purchases rose 2.1%	
United States (multiple cities)	Local excise taxes, e.g., Berkeley, Philadelphia, Seattle, Oakland, San Francisco, Boulder (1–2 cents/oz.)	Meta-analysis of natural experiments found taxes raised prices and reduced sales/purchases, with effects varying by city and product category	[8]
Philadelphia (chain retailers)	1.5 cents/oz. excise, effective Jan. 2017	Taxed beverage volume sales fell approximately 38% in year one at chain retailers, with a sustained decline through year two; cross-border purchasing offset roughly one-quarter of the within-city decline	[9,10]
Seattle, San Francisco, Oakland, Philadelphia	Local excise taxes (1–2 cents/oz.)	Sweetened beverage taxes associated with a decrease in consumption of nearly 50% among lower-income households	Reported in 2024 household purchasing study
Malaysia (national)	MYR 0.40/liter excise on SSBs >5g sugar/100mL, effective July 2019	Estimated 8.33% retail price increase; own-price elasticity of –1.11 implies an estimated 9.25% decline in consumption	[14]
United Kingdom (Soft Drinks Industry Levy)	Tiered levy (18p/24p per liter) on drinks ≥5g and ≥8g sugar/100mL, effective April 2018, announced 2 years in advance	Reformulation accounted for an estimated 83% of levy-associated calorie reduction; corrected household analysis found an approximate 3% reduction in sugar purchased from soft drinks, alongside substantial reductions in the sugar content of the product category overall	[11–13]
Cross-national (29 studies)	Tax rates ranging 10–25% across simulation and empirical studies	Simulation models consistently project reduced NCD incidence and higher government revenue; empirical evidence shows more limited impact, largely attributed to low tax rates	[1]



Moderators of Policy Effectiveness

Across the reviewed studies, four design features consistently moderate the size of measured consumption effects. First, tax magnitude matters: rates below roughly 10 percent appear to generate only modest price signals, while the cross-national systematic review attributes much of the empirical–simulation gap to jurisdictions implementing rates toward the lower end of the 10–25 percent range studied [1]. Second, tax structure matters: specific excise taxes levied per unit volume, as used in Mexico and most U.S. cities, tend to be more fully passed through to shelf prices than ad valorem taxes calculated as a percentage of wholesale price, which retailers can more easily absorb or obscure. Third, the availability and relative price of untaxed substitutes shapes net dietary impact: consistent evidence of a 2 to 4 percent rise in untaxed beverage purchases following SSB taxation indicates that some, but not all, forgone sugary-drink calories are being replaced by equally caloric alternatives, meaning consumption-volume reductions likely overstate reductions in total sugar and calorie intake unless substitution patterns are also measured. Fourth, and evident chiefly in the UK case, tax–reformulation linkage matters: levies tiered to sugar content, particularly when announced with a multi-year lead time, incentivize manufacturers to reformulate products below the taxed threshold, producing sugar-intake reductions that a purchase-volume-only evaluation would substantially understate.

Proposed Evaluation Framework

To resolve inconsistencies across existing studies, future SSB tax evaluations should adopt a standardized three-component design. First, retail point-of-sale scanner data should be used to establish objective, high-frequency measures of price pass-through and unit sales for both taxed and untaxed beverage categories, compared against a synthetic control or matched-jurisdiction counterfactual rather than a simple pre–post comparison. Second, longitudinal household purchase panels, stratified by income quintile, should be maintained for at least three years post-implementation to distinguish short-term novelty effects from sustained behavior change and to capture the differential impact on lower-income households documented in both the Mexican and U.S. literature. Third, where feasible, dietary biomarker substudies (for example, urinary sugar or hemoglobin A1c trends in a cohort subsample) should supplement purchase-based proxies, since purchase data alone cannot capture within-household reallocation, food waste, or out-of-home consumption. Figure 4 illustrates the

proposed sequencing of these three data streams relative to tax implementation.

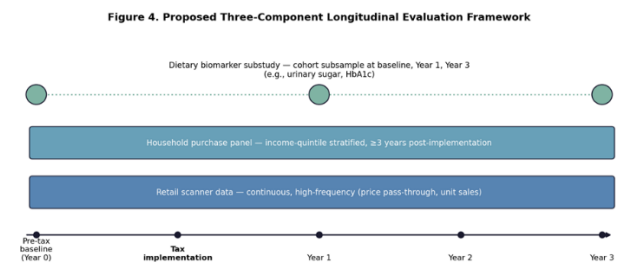


Figure 4. Proposed three-component longitudinal evaluation framework

This three-component structure builds on, rather than departs from, existing recommendations: The World Health Organization's 2016 technical guidance on fiscal policy monitoring already calls for combining purchase and sales data with biomarker evidence where feasible, and several of the 29 reviewed studies independently proposed elements of a similar design. What is proposed here differs in three specific respects rather than in kind. First, it requires the three data streams to run concurrently within a single evaluation design, rather than treating biomarker or income-stratified purchase data as optional supplements pursued only where convenient — a distinction the comparison in Table 2 makes explicit. Second, it specifies a minimum three-year post-implementation window and mandatory income-quintile stratification, both of which existing guidance recommends only in general terms. Third, recognizing that not every jurisdiction, particularly lower-resource settings, can immediately implement the full design, the framework is presented in graded form, distinguishing essential (minimum viable) components from ideal (full) components, so that partial adoption still yields evaluable, comparable data rather than an all-or-nothing standard (Table 3).

Table 2: Comparison of the Proposed Framework with Existing Guidance and Typical Published Practice

Design feature	WHO (2016) fiscal-policy monitoring guidance	Typical published evaluations (this review's 29 studies)	Framework proposed here
Data source(s)	Recommends purchase/sales data; biomarkers mentioned as aspirational	Overwhelmingly single-source: either scanner/sales data or self-report	Requires concurrent scanner data + purchase panel + biomarker substudy
Counterfactual	Pre/post comparison generally accepted	Mixed: pre/post, synthetic control, or matched jurisdiction, inconsistently applied	Synthetic control or matched-jurisdiction counterfactual specified as the default
Income stratification	Recommended but not operationalized	Reported in a minority of studies (chiefly	Mandatory income-quintile

		Mexico and U.S. select cities)	stratification for ≥3 years
Minimum duration	Not specified	Typically 1–2 years post-implementation	≥3 years, to separate novelty effects from sustained change
Tiered implementation	Not addressed	Not addressed in most designs	Graded “essential vs. ideal” component tiers (Table 3) for lower-resource settings

Table 3: Graded Evaluation Framework: Essential vs. Ideal Components

Component	Essential (minimum viable evaluation)	Ideal (full framework)
Price/sales data	Retail scanner or administrative sales data for taxed and untaxed categories, pre/post comparison	High-frequency scanner data with synthetic control or matched-jurisdiction counterfactual
Household purchasing	Single cross-sectional household survey ≥12 months post-implementation	Longitudinal purchase panel, stratified by income quintile, sustained ≥3 years
Biological outcomes	Not required	Dietary biomarker substudy in a cohort subsample (e.g., urinary sugar, HbA1c) at baseline, Year 1, and Year 3
Reformulation tracking	Periodic audit of taxed-category sugar content (annual)	Continuous product-level sugar-content monitoring linked to the levy threshold
Reporting	Pre/post percentage change with confidence interval	Full PRISMA-style documentation of design, comparator, and pooled effect size for cross-study synthesis

Applying this framework consistently across newly adopting jurisdictions would allow future systematic reviews to pool comparable effect sizes rather than the heterogeneous mix of modeling and empirical estimates that currently complicates cross-study synthesis.

Health Equity and Revenue Use

The evidence reviewed in Evidence from Mexico's National SSB Tax through Evidence from the United Kingdom and Asian Jurisdictions, consistently finds that SSB tax responses are largest among lower-income households — the same households that face disproportionate exposure to diet-related disease. This pattern creates a genuine policy tension. As a consumption tax on a good that constitutes a larger share of spending among lower-income households, an SSB excise tax is regressive with respect to household income: for a given percentage price increase, lower-income households bear a proportionally larger financial burden. At the same time, because these households also show the largest behavioral response, and therefore the largest reduction in diet-related disease risk, the same tax may be progressive with respect to health benefit. Reconciling these two facts is central to how SSB taxation should be evaluated and defended as public health policy, not a peripheral caveat.



This tension is often addressed through “double dividend” arguments: that SSB taxes generate both a health benefit (reduced consumption and downstream disease burden) and a fiscal dividend (tax revenue), and that directing the fiscal dividend back toward the population bearing the financial burden can offset the regressivity of the tax itself. The Philadelphia case offers a concrete illustration, since revenue from that tax was earmarked substantially for pre-kindergarten slots in the city; more generally, several jurisdictions have earmarked SSB tax revenue for nutrition, dental health, or school health programs targeted at lower-income communities. Whether revenues are earmarked in this way, however, is a distinct policy choice from the tax’s design, and the studies reviewed here rarely evaluate revenue use as a component of overall equity impact — a gap consistent with the broader limitation, discussed in Implications and Limitations, that most evaluations focus narrowly on consumption outcomes rather than on the full welfare or distributional consequences of the policy.

A further equity consideration, distinct from the regressivity of the tax itself, is the risk that substitution could exacerbate rather than narrow health disparities. If lower-income households, facing the largest price signal, substitute toward untaxed but still unhealthy products — for example, less expensive high-sugar foods not captured by a beverage-only tax, as suggested by the Philadelphia food-substitution evidence discussed in Evidence from United States Jurisdictions — then a policy intended to reduce health disparities could partly reproduce them through an untaxed channel. This risk strengthens, rather than weakens, the case for monitoring substitute-category pricing and for pairing SSB taxation with complementary policies, discussed further in Limitations.

Policy Implications

Translating the evidence synthesized above into actionable guidance for policymakers requires attention not only to what design features are associated with larger effects, but to which recommendations are most feasible to implement and in what sequence. Table 4 prioritizes the review’s policy recommendations.

Table 4: Prioritized Policy Recommendations

Priority	Recommendation	Feasibility note
High	Set specific excise rates at or above ~20% of pre-tax price where politically feasible; avoid ad valorem structures	Requires legislative action; higher rates face stronger industry opposition
High	Structure any tiered levy with a 1–2 year lead time between announcement and implementation to incentivize reformulation	Administratively straightforward; UK SDIL precedent available
Medium	Earmark a defined share of revenue for nutrition or health programs targeted at lower-income populations	Politically popular but requires dedicated budgetary mechanisms
Medium	Pair taxation with front-of-pack warning labels and	Complementary policy; evidence base for combined effects still developing

	restrictions on marketing to children	
Medium	Monitor pricing of untaxed substitute categories to prevent full caloric offset	Requires ongoing retail data infrastructure
Low	Extend national-level taxation where politically viable to reduce cross-border substitution	High political economy barriers in federal systems (e.g., United States)

Two further considerations bear on implementation feasibility. First, political economy: SSB taxes routinely face well-resourced industry opposition, and the cross-border substitution evidence from Philadelphia and other U.S. cities illustrates a specific vulnerability of subnational taxation — namely, that a municipality acting alone bears the political cost of the tax while losing a share of its intended consumption effect to untaxed neighboring jurisdictions. National-level taxation, where politically achievable, avoids this specific failure mode, though it raises its own political economy barriers, particularly in federal systems. Second, complementary policy design: the evidence in this review is consistent with taxation functioning best as one component of a broader policy package rather than as a stand-alone intervention — front-of-pack warning labeling and restrictions on marketing to children are the two complementary measures most frequently discussed alongside SSB taxation in the reviewed literature, though a full evaluation of their combined, as opposed to independent, effects remains an open area for future research.

12. Implications and Limitations

For policymakers, the reviewed evidence suggests that SSB taxes are most likely to achieve meaningful consumption reductions when set at or above approximately 10 percent, structured as a specific excise on volume rather than an ad valorem rate, and paired with monitoring of substitute-beverage pricing to prevent full caloric offset. The disproportionately large response among lower-income households, replicated in both Mexico and multiple U.S. cities, strengthens the public health rationale for SSB taxation but also raises equity considerations, discussed in Health Equity and Revenue Use, since excise taxes are regressive with respect to income even as they may be progressive with respect to health benefit.

This review is subject to several limitations beyond its reliance on secondary synthesis of published evaluations rather than original data analysis. First, publication bias is a plausible concern: studies finding statistically significant consumption reductions are more likely to be published and cited than null or mixed findings, which may bias the reviewed literature toward larger apparent effects. Second, outcome measures are markedly heterogeneous across the 29 included studies — some report purchases, others sales, others self-reported consumption or dietary recall, and others modeled elasticity-based projections — which limits direct comparability and precluded formal meta-analytic pooling in this review (see Methodology). Third, the concentration of high-quality natural-experiment evidence in a small number of middle- and high-income jurisdictions (chiefly Mexico, the United States,

and the United Kingdom) means this review's conclusions may not generalize well to low-income countries, where retail infrastructure, informal-market beverage sales, and household purchasing-panel data are less developed. Fourth, the relatively short post-implementation windows (typically one to three years) available in most studies limit conclusions about long-run habituation, industry reformulation responses, or cumulative health outcomes. Fifth, isolating the SSB tax's own effect from concurrent policies — such as the front-of-pack labeling and marketing restrictions discussed in Limitations, which several reviewed jurisdictions adopted around the same time as their SSB tax — is difficult in observational natural-experiment designs, and few of the reviewed studies explicitly attempt to disentangle these overlapping interventions.

Conclusion

The empirical record on sugar-sweetened beverage taxation is more mixed than early simulation modeling suggested, but a coherent pattern nonetheless emerges: taxes in the 10 percent range or higher, well passed through to retail prices, measurably reduce purchases of taxed beverages, with the largest declines concentrated among the households facing the greatest diet-related health risk. Where levies are additionally tiered to sugar content, as in the United Kingdom, industry reformulation offers a second, largely distinct channel through which taxation reduces population sugar intake, one that purchase-volume metrics alone do not fully capture. Closing the gap between projected and observed effects will require both higher, better-enforced tax rates and more standardized, longitudinal evaluation designs — of the kind proposed in Evaluation Framework — capable of isolating substitution effects, reformulation effects, and long-term dietary change from short-term price responses, while attending explicitly to the equity and revenue-use questions that determine whether SSB taxation narrows or reproduces existing health disparities.

Conflict of Interest: NIL

Funding Sources: NIL

References

- [1] Firdaus S, Andarwulan N, Hariyadi P. Modeling and empirical evidence of the impact of implementation of sugar sweetened-beverages tax to reduce non-communicable diseases prevalence: a systematic review. *Front Nutr*. 2024; 11:1448300. doi:10.3389/fnut.2024.1448300
- [2] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372: n71. doi:10.1136/bmj. n71
- [3] Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute; 2000.
- [4] Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. 2017;358: j4008. doi:10.1136/bmj. j4008
- [5] Basto-Abreu A, Barrientos-Gutiérrez T, Vidaña-Pérez D, Colchero MA, Hernández-F M, Hernández-Ávila M, et al. Projected impact of Mexico's sugar-sweetened beverage tax policy on diabetes and cardiovascular disease: a modeling study. *PLoS Med*. 2018;15(1): e1002158. doi: 10.1371/journal.pmed.1002158
- [6] 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. doi:10.1377/hlthaff.2016.1231
- [7] Lozano-Rojas F. The effect of soda taxes beyond beverages in Philadelphia. *Health Econ*. 2022;31(11):2381-410. doi:10.1002/hec.4586
- [8] Shen J, Wang J, Yang F, An R. Impact of soda tax on beverage price, sale, purchase, and consumption in the US: a systematic review and meta-analysis of natural experiments. *Front Public Health*. 2023; 11:126569. doi:10.3389/fpubh.2023.1126569
- [9] 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. doi:10.1001/jama.2019.4249
- [10] Petimar J, Gibson LA, Yan J, Bleich SN, Mitra N, Trego ML, et al. Sustained impact of the Philadelphia beverage tax on beverage prices and sales over 2 years. *Am J Prev Med*. 2022;62(5):921-9. doi: 10.1016/j.amepre.2022.02.001
- [11] Pell D, Mytton O, Penney TL, Briggs A, Cummins S, Penn-Jones C, et al. Changes in soft drinks purchased by British households associated with the UK soft drinks industry levy: controlled interrupted time series analysis. *BMJ*. 2021;372: n254. doi:10.1136/bmj. n254
- [12] 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. doi: 10.1371/journal.pmed.1003025
- [13] Dickson A, Gehrsitz M, Kemp J. Does a spoonful of sugar levy help the calories go down? An analysis of the UK Soft Drinks Industry Levy. IZA Discussion Paper No. 14528. Bonn: IZA Institute of Labor Economics; 2021.
- [14] Mohamed Nor N, Bui Kher Thinnng W, Veerman JL, Ibrahim NS, Mohamad FZ, Ibrahim S. Price elasticity of demand and the impact of taxing sugar-sweetened beverages in Malaysia. *Malays J Public Health Med*. 2021;21(1):223-9. doi:10.37268/mjphm/vol.21/no.1/art.794
- [15] Selimin DS, Mohd Sobri HN, Mat Reffien MA, Syed Rosli SAS, Noor Hassim NH, Li HY, et al. Soda tax impact on soft drinks consumption: a systematic review. *Glob J Public Health Med*. 2024;6(1):932-45. doi:10.37557/gjphm. v6i1.239
- [16] Baethge C, Goldbeck-Wood S, Mertens S. SANRA—a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev*. 2019; 4:5. doi:10.1186/s41073-019-0064-8
- [17] Sassano M, Castagna C, Villani L, Quaranta G, Pastorino R, Ricciardi W, et al. National taxation on sugar-sweetened beverages: a systematic scoping review and time series analysis. *Am J Clin Nutr*. 2024;119(4):990-1006. doi: 10.1016/j.ajcnut.2023.12.013

Declarations:**Authors' Contribution:**

- All Authors Conceptualization, data collection, interpretation, drafting of the manuscript and intellectual revisions
- The authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

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