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Umbrella Review

An umbrella review of the acceptability of fiscal and pricing policies to reduce diet-related noncommunicable disease

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Context: *Poor diet has been implicated in a range of noncommunicable diseases. Fiscal and pricing policies (FPs) may offer a means by which consumption of food and non-alcoholic beverages with links to such diseases can be influenced to improve public health.* ***Objective:*** *To examine the acceptability of FPs to reduce diet-related noncommunicable disease, based on systematic review evidence.* ***Data Sources:*** *MEDLINE, EMBASE, PsychInfo, SCI, SSCI, Web of Science, Scopus, EconLit, the Cochrane Library, Epistemonikos, and the Campbell Collaboration Library were searched for relevant studies published between January 1, 1990 and June 2021.* ***Data Extraction:*** *The studies included systematic reviews of diet-related FPs and: used real-world evidence; examined real or perceived barriers/facilitators; targeted the price of food or non-alcoholic beverages; and applied to entire populations within a jurisdiction. A total of 9996 unique relevant records were identified, which were augmented by a search of bibliographies and recommendations from an external expert advisory panel. Following screening, 4 systematic reviews remained.* ***Data Analysis:*** *Quality appraisal was conducted using the AMSTAR 2 tool. A narrative synthesis was undertaken, with outcomes grouped according to the WHO-INTEGRATE criteria. The findings indicated a paucity of high-quality systematic review evidence and limited public support for the use of FPs to change dietary habits. This lack of support was related to a number of factors that included: their perceived potential to be regressive; a lack of transparency, ie, there was mistrust around the use of revenues raised; a paucity of evidence around health benefits; the deliberate choice of rates that were lower than those considered necessary to affect diet; and concerns about the potential of such FPs to harm economic outcomes such as employment.* ***Conclusion:*** *The findings underscore the need for high-quality systematic review evidence on this topic, and the importance of responding to public concerns and putting in place mechanisms to address these when implementing FPs. This study was funded by Safefood [02A-2020].* ***Systematic Review Registration:*** *PROSPERO registration no. CRD42021274454.*

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INTRODUCTION

Poor quality diets, specifically those high in salt, sugar, and fat and low in fruit, vegetables, legumes, and nuts, represent major risk factors affecting the global burden of disease.[1–3] A number of policy actions have been promoted to help counter the rise in diet-related noncommunicable disease (NCD), including fiscal and pricing policies, henceforth FPs.[4–6]

A distinction has been made between downstream interventions, which seek to change the diets of certain individuals, and upstream interventions, which seek to change the dietary environment for society.[7–9] Upstream interventions, such as FPs, can avoid stigmatization of targeted groups and may be better aligned with equity-oriented governance.[10] While they may be more effective than downstream interventions, they can also be more complex to implement.[9,11–13]

There is evidence, albeit largely from simulated studies, that FPs can be used to change behavior and improve health as well as reduce socioeconomic disparities in health.[14–18] However, the use of research evidence in public health policy making bears little resemblance to the systematic and hierarchical process of evidence-based medicine.[19,20] Rather than a linear sequence of identifying a problem all the way through to treatment evaluation using a hierarchy of evidence, policy development usually occurs in a complex and nonlinear fashion, requiring a range of evidence of varyious types depending on the problem.[20,21] An appreciation of this complexity is required if the barriers and facilitators (B/Fs) to adoption of FPs are to be identified and successfully navigated.[13,22] Recent examples of implemented FPs that have been repealed, and their effects reversed,[23–25] highlight the need to consider acceptability and not just effectiveness as part of successful health policy implementation.

Several political process theories have been developed in recognition of this complex policy-making endeavor.[13,26] Kingdon's Multiple Streams Framework for agenda setting outlines 3 separate but complementary streams: problem, policy, and politics.[27] When these streams are aligned it creates a window of opportunity in which successful policy implementation can occur. This theory has been widely used to address agenda setting as well as policy adoption and implementation, especially in relation to diet-related FPs.[13,26,28–30] The problem of diet-related NCDs is widely acknowledged, and the specific type of policies focused on here are diet-related FPs.

The focus of this review is on the politics: examining reviews of the acceptability of FPs applied to food and non-alcoholic beverages to improve diet and reduce diet-related NCDs. As the topic of acceptability of FPs has grown, so too has the number of studies and systematic reviews examining it.[15,31–35] Umbrella reviews provide an important tool for policy makers by summarizing the highest level of evidence, namely systematic reviews and meta-analyses, in relation to a research topic or question.[36]

METHODS

Acceptability is defined here as the degree to which individuals or groups experience or perceive B/Fs linked to the implementation and proposed implementation of such policies.[33] Acceptability is a multifaceted concept; Sekhon et al (2017) describe it as the extent to which deliverers or receivers of a health intervention perceive it to be appropriate according to anticipated or experienced cognitive or emotional responses to the intervention.[37] They include components such as "perceived effectiveness" (eg, how effective the public or policy makers expect a FP to be in improving health or reducing consumption of health-harming products/nutrients) and "opportunity costs" (eg, the potential economic output foregone or employment lost from implementing a FP). These components are considered in the examination of B/Fs, while grouping B/Fs according to the criteria in the WHO-INTEGRATE framework (below), which are used to guide evidence for decision making on complex health interventions, according to WHO norms and values.[22]

Assessing acceptability prior to implementing a policy highlights aspects that could be modified to increase acceptability.[37] The perspective adopted is that of a policy maker who is interested in implementing diet-related FPs and must therefore consider evidence regarding their effectiveness (in this case in reducing diet-related NCDs), as well as broader considerations relating to their acceptability. A separate umbrella review (CRD42021249212) has been conducted by this research team examining the actual effectiveness of FPs in improving diet and health according to the following WHO-INTEGRATE criteria:

1. "Balance of health and benefits" – the magnitudes and types of health benefit from intervention and
2. "Health equity, equality and non-discrimination" – an effort to improve health and reduce structural differences in health across populations.

Consequently, this review does not examine the effectiveness of FPs except in so far as they relate to their perceived effectiveness in reducing diet-related NCDs. The other WHO-INTEGRATE criteria considered in this review of acceptability are:

3. "Human rights and sociocultural acceptability" – an intervention's impact on human rights or the extent

to which stakeholders consider it to be appropriate based on their cognitive or emotional responses.
4. "Societal implications" – an intervention's wider economic, social and environmental associations.
5. "Financial and economic considerations" – the economic impact on the health system, government, and society.
6. "Feasibility and health system considerations" – an intervention's interaction with legislation and governance, the structure of the health system, other programmes, human resources, and infrastructure.
7. "Quality of evidence" is considered across these criteria and is described in the "Quality appraisal" section.

Search strategy

The umbrella review protocol for this study was registered at the International Prospective Register of Systematic Reviews (PROSPERO; registration number CRD42021274454, please see Figure S1 in the Supporting Information online). MEDLINE, EMBASE, PsychInfo, SCI, SSCI, Web of Science, Scopus, EconLit, the Cochrane Library, Epistemonikos, and the Campbell Collaboration Library were searched for eligible systematic reviews published between January 1, 1990 and June 2021. A range of search terms were used to cover 3 themes for relevant systematic reviews. Specifically, it was required that: (1) the study type must be a systematic review (defined according to the Cochrane Handbook for Systematic Reviews of Interventions[38]) with or without meta-analysis; (2) it must focus on FPs, such as taxes or subsidies; and (3) the intent must have been to change diet with a view to reducing NCD risk.

A list of search terms were identified across these 3 themes using Boolean "or" operators (for terms within each theme) and "and" operators (for terms overlapping between themes) (see Table S1 in the Supporting Information online). Where a data base provided tools to further limit the search strategy, studies were restricted to those of "humans" (MEDLINE, EMBASE, PsychInfo), and systematic reviews or meta-analyses (MEDLINE, PsychInfo, Scopus), and a data base tool designed to achieve a balance between the sensitivity and specificity of searches for systematic reviews was applied (MEDLINE).[39] The Peer-Review of Electronic Search Strategies (PRESS) guidelines was followed in designing the search strategy, though it was not peer reviewed.[40] Two data bases (The Campbell Collaboration Library and Google Scholar) required simplified search strategies; full details of these and all other search strategies can be found in the Supporting Information (please see Tables S2.A–S2.J in the Supporting Information online). To help validate the search strategy, 2 systematic reviews were identified that were expected, a priori, to be relevant to this umbrella review,[15,33] and these were used these to test the strategy but not to design it: if a search data base indexed the validation reviews, then the search was required to include it. For Google Scholar, first the search on all other data bases was completed, and then this consolidated list was compared with the returns from the first 5 pages (50 records) returned, to determine whether any additional studies merited inclusion.

Screening

One reviewer (L.E.B.) executed the search strategy, collated the results and removed the duplicates (using EndNote 20 software).[41] Two reviewers (C.O.N. and L.B.) independently screened article titles to remove redundancies and compared results before finalizing a list of articles for abstract screening. Disagreements were discussed until consensus was reached. While provision was made for input from a third reviewer (F.K.) in the case of disagreement among the first 2 reviewers, ultimately this was not required. Next, abstracts were screened using the same process followed by a full-text screening. Reference lists were searched, authors contacted, and expert opinion sought, to identify any additional relevant studies and to acquire full texts where necessary. For any articles that required translation into English, initially online translation software (Google Translate) was used to identify any clear reasons for exclusion. While provision for a professional translation service was made, ultimately this was not required.

Inclusion and exclusion criteria

All systematic reviews examining B/Fs related to FPs implemented by governments to improve population diet were included. Reviews eligible for inclusion:

i. conducted a systematic review with or without meta-analysis
ii. examined acceptability in relation to an implemented government policy or one proposed by government that targeted the price of a good
iii. used real-world evidence (RWE), ie, not simulated models
iv. examined policies that targeted the consumption of food and non-alcoholic beverages, ie, not agricultural policies with unintended impacts upon consumption
v. examined real or perceived B/Fs experienced by the public or political groups: for example, a real or perceived reduction in local employment from a food tax, as well as actions taken by them in relation to such B/Fs (eg, lobbying)

vi. examined policies that applied to the entire population of its jurisdiction, so that experiments of price discounts in supermarkets or targeted food programs were excluded.

Criteria for qualification as a systematic review were taken from the Cochrane Handbook for Systematic Reviews of Interventions.[38] Reviews were therefore excluded if they did not provide: (i) a clearly stated set of objectives with predefined eligibility criteria for studies; (ii) an explicit, reproducible methodology; (iii) a systematic search that attempted to identify all studies that would meet the eligibility criteria; (iv) an assessment of the validity of the findings of the included studies; and (v) a systematic presentation, and synthesis, of the characteristics and findings of the included studies.

Reviews of modeling/simulation studies (ie, those that simulate a result) and theoretical studies were excluded. If a review included studies that satisfied the inclusion criteria (ie, RWE examining an implemented or proposed diet-related FP applied across an entire population of its jurisdiction) as well as studies that did not (eg, a modeling study of the same intervention), the review and reported results relating only to the relevant studies were included, if these were presented separately. If the original reviewers had combined the findings of modeling or theoretical studies with those examining RWE, the combined results were used, while noting reviews that included a mix of results as part of data synthesis. Reviews noting the existence of a policy but not discussing B/Fs with respect to it were not included. The PICOS criteria are described in Table 1.

Table 1 **PICOS criteria for inclusion of studies**

Parameter	Criterion
Participants	Any individuals or groups (the public or policy makers) in any country. Subgroup reporting according to PROGRESS-PLUS characteristics
Interventions	Implemented government fiscal or pricing policies or ones proposed by government that target the price of food or non-alcoholic beverages and are applied to the entire population within a jurisdiction
Comparisons	None required
Outcomes	Real or perceived barriers or facilitators experienced by the public or political groups, as well as actions taken by them in relation to such barriers/facilitators and grouped according to WHO-INTEGRATE framework criteria
Study design	Conducted as a systematic review with or without meta-analysis and used real-world evidence

Quality appraisal

As part of the original protocol, it was intended that quality appraisal and data extraction would be conducted in duplicate; however, due to time constraints, the methodological quality of 25% of the systematic reviews included for final review were assessed in duplicate (by L.E.B. and C.O.N.) using the AMSTAR 2 tool.[42] Disagreements were resolved by discussion and where necessary by reference to a third reviewer (F.K.), though this was not required. The rest of the reviews were appraised by 1 reviewer (L.E.B.), and the results were discussed with an independent expert advisory panel (EAP) established to advise on the conduct of the umbrella review. The EAP comprised researchers with international reputations in the areas of public health and economics. Details of the EAP are contained in Table S3 in the Supporting Information online. The AMSTAR 2 tool allows a broad indication of whether the quality of a review is high, moderate, low, or critically low by a count of the number of critical and noncritical domain flaws present. Given that some reviews included qualitative studies (eg, focus group discussions), these AMSTAR 2 criteria were adapted: the reviews were not required to explicitly specify a comparator, where one could be inferred, for example, and where no quantitative analysis was conducted reviews were not graded on related criteria. It was planned to exclude all those reviews that received more than 1 critical domain flaw; however, this criterion was relaxed, as all of the potentially included reviews (see Table S4 in the Supporting Information online) had 2 or more critical domain flaws. As such, the synthesis was based on those reviews with 3 or fewer critical domain flaws. The quality rating applied to reviews in this umbrella review does not necessarily reflect the overall quality of the review, but rather reflects its quality in addressing the umbrella review question.

Data extraction

Data extraction was carried out using an online form to document review features: aims, methods, eligibility criteria, search strategy, funding sources, setting, participants, intervention (and comparator where available), outcomes measured, research design, outcomes reported, any subgroup analyses related to specific groups of participants, and any distributional impacts examined using axes of differentiation according to PROGRESS-Plus,[43] given the potential for inequalities to arise across groups differentiated in ways other than socioeconomic status.[44] The extraction form was trialed by 2 reviewers (L.E.B. and C.O.N.), each trialing it on 3 systematic reviews before it was finalized.[45] As with the

quality appraisal, extraction was performed in duplicate (L.E.B. and C.O.N.) on 25% of the articles. These results were compared between reviewers, and guidelines were developed on how best to extract information from the remaining studies in a consistent manner, which was completed by 1 reviewer (L.E.B.).

Synthesis

Given the relatively few reviews that met the eligibility criteria (of which only 1 included a meta-analysis) and the heterogeneity across them, a narrative synthesis of the included systematic reviews was conducted,[46] following exclusions based on the quality appraisal. Data were grouped according to the nature of the results being reported, using thematic analysis whereby review results were categorized into subthemes using an inductive approach (or using themes identified by the review authors). Once the review results were extracted according to subthemes, these were further grouped according to the WHO-INTEGRATE criteria.[22] These criteria were designed to guide the use of evidence for decision making for complex health interventions, such as diet-related FPs. This made them suitable for structuring the results, while improving transparency in defining themes, which can be an issue when using an inductive approach.[46] The number of results (relating to subthemes) that appear under each WHO-INTEGRATE criterion provides a useful way of identifying information gaps (when considering the acceptability of FPs) or identifying the criteria most important to stakeholders as part of the prioritization of B/Fs. While some subthemes could be classified under multiple criteria, to allow for interpretation and prioritization of the results, a single criterion judged to be most relevant to each subtheme was highlighted.

A summary of each review is presented in Table 2.[33,47–49] Table 3[33,47–49] provides an overview of the evidence regarding the documented B/Fs in relation to FPs, reported according to subthemes and grouped according to the WHO-INTEGRATE criteria.[22] Where quantitative results were provided as part of a meta-analysis, these are reported in Table 3, as were any distributional/subgroup results.

Robustness check

While umbrella reviews summarize high-level evidence from systematic reviews, they are restricted in their timeliness, because they can only use evidence from primary studies that had been published before the most recent systematic review search date. While the search covered the period up to June 2021, the most recent systematic review search date was October 2019. As countries have continued to implement FPs, a literature review of primary studies published between January 2020 and November 2021 was conducted to examine whether these supported or conflicted with the results of the umbrella review. This literature review used: the search strategy from the umbrella review; applied only to EMBASE (given its high yield of eligible reviews: see "Results"); was updated to focus only on English language journal articles referencing tax or subsidies in the title and excluding references to alcohol or tobacco in the title (please see Table S5 in the Supporting Information online). Although the search was more restrictive (by data base and language), was conducted at a high-level by only 1 reviewer (L.E.B.), and did not involve quality assessment, it provides a useful overview of primary studies after 2019 that examine the acceptability of taxes and subsidies, with which the umbrella review results can be compared.

RESULTS

Screening

A total of 16 883 records were identified through data base searches, resulting in 9996 unique records once duplicates were removed (Figure 1). After title and abstract screening, this was reduced to 66 records, with 4 additional records identified based on recommendations from experts in the field and searches of reference lists. One article in Dutch was translated online for full-text screening, and the rest were in English. Following full-text screening, a further 60 records were excluded (the Dutch article was excluded as it did not qualify as a systematic review), leaving 11 potentially relevant records for data extraction. The list of all 11 potentially relevant reviews is detailed in Table S6 in the Supporting Information online, along with a summary of the data bases in which they were indexed. Two of these reviews were identified after screening from Google Scholar and reference list searching.[50,51] Of the other 9 reviews, 100% of these were indexed across 2 data bases (MEDLINE = 8 out of 9; EMBASE or Scopus = 7 out of 9).

Quality appraisal

Following quality appraisal, all reviews were assessed to have 2 or more critical flaws and thus received a "critically low" AMSTAR 2 rating. As such, the synthesis was based on the 4 reviews with only 2–3 critical domain flaws. The main reasons for these ratings were: not including a list of potentially relevant but excluded studies (n = 4 out of 4) and not justifying publication restrictions (n = 3 out of 4) (please see Table S4 in the

Table 2 **Characteristics of reviews included in the narrative synthesis**

Reference	Research design	Synthesis method	Population	Intervention	No. of data bases	Search period	Search restrictions	No. of included studies	AMSTAR 2 rating
Eykelenboom et al 2019[33]	NRSI; RCT; mixed-methods studies; qualitative studies; surveys	Thematic synthesis and meta-analysis	Any individuals involved in the decision-making process (eg, policy makers, politicians, and officials of ministries) or any individuals potentially affected by a SSBs tax (ie, the public)	FP (taxes) on SSB's	4	Earliest date up to November 2018	English language	37	CL
Mounsey et al 2020[49]	NRSI; models	Narrative synthesis	National economies	FP (taxes) on SSB's and energy-dense foods	7	Earliest date up to November 2018 (1 article from 2019 included after search date)	English language	11	CL
Dodd et al 2020[47]	NRSI; models; experiments; surveys	Narrative synthesis	Any population, any age, any setting, any country	FP (taxes) on salt and foods high in salt	12	January 2000 to October 2019	None	18	CL
Niebylski et al 2015[48]	NRSI; RCT; models; reviews; experiments; surveys	Narrative synthesis	Adults and children, any setting, in Western Europe, Canada, United States, Australia, and New Zealand	FP (taxes and subsidies) to promote healthy diet	4	June 2003 to November 2013 (Google Scholar – June and November 2013)	Peer-reviewed; English language	78	CL

Note: the populations have been described as they were described by the review authors. Where the population inclusion criteria were not described in the review, it was assumed that "any" population, age, setting, or country had the potential to be included. *Abbreviations:* CL, critically low; FP, fiscal and pricing policies; NRSIs, non-random studies of interventions; RCT, randomized controlled trials; SSB, sugar-sweetened beverages.

Table 3 **Acceptability of intervention strategies synthesized by included systematic reviews**

Reference	Intervention	Subtheme	Narrative synthesis results	Meta-analysis results	Distributional results
Financial and economic considerations					
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Macroeconomic impacts	Beliefs that an SSB tax may have negative macroeconomic impacts – "Concerns about the negative impact of an SSBs tax on the economy were reported in 4 studies on political [n = 2] and public acceptability [n = 3], such as concerns about a reduction in jobs and closing of SSB companies as a result of the tax."	–	–
		Revenue generation	Beliefs that SSB taxes would be effective in raising revenue for social, health, and general budgets – "the potential to raise revenue for societal health programs (eg, for prevention funds, sport fields and recreational activities) was perceived as a positive consequence of implementation" AND "The potential of an SSBs tax to raise revenue for health care (eg, for the National Health Service) was identified in three studies on political and public acceptability." AND "Four studies on political acceptability reported that an SSBs tax was viewed as a potential to raise revenue for the general budget"	"Pooled proportions indicated that of the public . . . 39% (0.36–0.41) believed that an SSBs tax has the potential to raise revenue for societal health programs"	–
Mounsey et al 2020[49]	FP (taxes) on SSBs and energy-dense foods	Employment	Lack of evidence (except from modeling studies) that diet-related taxes result in net unemployment – "the three non-industry supported peer-reviewed academic studies found none of the significant job losses industry reports suggested, but found instead, no significant net decline in employment and job creation."	–	–
		Gross domestic product	Evidence (from modeling studies) that SSB taxation would reduce GDP contributions; however, these were industry-funded and dependent on modeling assumptions – "the projections for reductions of approximately US$173 million and US $1 billion to GDP contributions from UK and South Africa analyses, respectively, were likely overestimated because of failure to incorporate milk and other substitutions across sectors, and for South Africa, the overshifting of the pass-through rate. It was also clear from the studies reviewed that the PE selected for modeling had a significant impact on the potential GDP effects of a tax."	–	–
		Industry sales	Evidence (from modeling studies) that SSB taxation would reduce sales revenue generation; however,	–	

(continued)

Table 3 **Continued**

Reference	Intervention	Subtheme	Narrative synthesis results	Meta-analysis results	Distributional results
			these were industry-funded and dependent on modeling assumptions – "Three reported the dollar value of sales revenue reductions (between $US13.3 and $US779 million), but not the total revenue prior to the tax, and one reported the percentage reduction in total revenue (23.5 %)" BUT "assumptions regarding the products taxed, wage fixing, the pass-through rate and substitution availability varied between papers, which have significant implications for the outcome of the models."		
		Revenue generation	Evidence (including modeling studies) that SSB taxation would increase government revenue – "Estimates ranged from between US$31 million to US$940 million, translating to per capita values of between US$1.05 to US$43.39. The most significant impacts on the magnitude of revenue were the tax levels imposed and onto what products, price-elasticity and substitution estimates."	–	"One study reported the cross-border shopping impact of the Philadelphia SSB tax on both beverages and non-beverage items and showed a gross loss from the local sales tax revenue that should have been collected"
Niebylski et al 2015[48]	FP (taxes and subsidies) to promote healthy diet	Revenue generation	Evidence (from modeling studies) that SSB taxation would increase government revenue and support for the allocation of revenue towards health initiatives – "In 2008, the CBO estimated that a federal excise tax of $0.03 per 12 ounces of SSB would generate an estimated $24 billion over 2009–2013 and $50 billion over 2009–2018." AND "Using tax revenue to fund NCD prevention programs and/or subsidize healthy foods was further recommended"	–	
Human rights and sociocultural acceptability					
Dodd et al, 2020[47]	FP (taxes) on salt and foods high in salt	Taxation as an intervention strategy	Lack of support for the introduction of tax to reduce salt consumption – "In Tonga, focus group discussions revealed food taxes to be unpopular with consumers, due to the cost for consumers" AND "In Ireland, salt tax was the least popular of proposed salt reduction initiatives" BUT "Support for salt taxation was highest amongst those who saw food manufacturers as responsible for reducing salt consumption, suggesting knowledge of the food production process could be key to winning public support"	–	–

(continued)

Table 3 **Continued**

Reference	Intervention	Subtheme	Narrative synthesis results	Meta-analysis results	Distributional results
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Mistrust	Beliefs that some stakeholders cannot be trusted as part of SSB tax policy process – "Mistrust of the industry was identified in five studies on public acceptability of an SSBs tax [n = 5]" AND "Public doubts were reported about [government's] use of raised revenue in four studies on public acceptability of an SSBs tax [n = 4]" AND "Mistrust of public health experts was expressed in one study on public acceptability"	"Pooled proportions indicated that of the public . . . 49% (0.32–0.66) mistrusted the industry, and 61% (0.56–0.67) mistrusted the government"	–
		Public support for SSB taxation	–	Quantitative estimates on public support for SSB taxation were pooled using a random-effects meta-analysis finding that – "42% of the public (95% CI = 0.38–0.47) supports an SSBs tax, 39% of the public (0.29–0.50) supports an SSBs tax as a strategy to reduce obesity, and 66% of the public (0.60–0.72) supports an SSBs tax if revenue is appropriately used."	–
		SSBs as an intervention target	Mixed beliefs as to whether SSBs are a good target for taxation as they provide pleasure but may also contribute to obesity – "Those supportive of an SSB tax believed that SSBs are a major contributor to obesity [n = 6], while opponents indicated a lack of personal evidence that SSBs can cause obesity and referred to the many other determinants of obesity [n = 4]."	"Pooled proportions indicated that of the public . . . 68% (0.48–0.85) believed that SSBs are an appropriate intervention target"	–
		Taxation as an intervention strategy	Mixed beliefs about whether taxation is an appropriate intervention strategy to reduce SSB consumption – "Taxation was viewed as an appropriate intervention strategy in the majority of studies on political acceptability. Taxation was also considered necessary in two studies on public acceptability. However, in other studies on political and public acceptability taxation was viewed as government intrusion."		–
Niebylski et al 2015[48]	FP (taxes and subsidies) to promote healthy diet	Taxation as an intervention strategy	Lack of support for taxation as a mean to improve diet – "A public opinion survey to examine attitudes on pro- and anti-food & SSB tax arguments . . . determined that more people agreed with antitax vs. protax arguments." AND "Policy support was highest for healthy lifestyle campaigns and food labelling but lowest for taxing unhealthy foods."	–	–

(continued)

Table 3 **Continued**

Reference	Intervention	Subtheme	Narrative synthesis results	Meta-analysis results	Distributional results
Balance of health benefits and harms					
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Cost-effectiveness	Beliefs that an SSB tax would be cost-effective – "An SSB tax was seen as a cost-effective intervention for improving public health nutrition and obesity prevention across six studies on political [n = 3] and public acceptability [n = 3]"	–	–
		Effectiveness	Beliefs that taxes would be effective in reducing SSB consumption – "The belief that an SSBs tax would be effective in reducing purchases and consumption of SSBs was reported in studies on political . . . and public acceptability."	"Pooled proportions indicated that of the public 39% (95% CI = 0.26–0.54) believed that an SSBs tax has impact on SSB purchases and consumption"	Belief that taxes would be ineffective in reducing SSB consumption among certain groups – "an SSBs tax was perceived to be ineffective in those addicted to SSBs, in those who lacked awareness of SSB prices, in those with obesity, and in rich and stubborn people."
		Health-related outcomes	Mixed beliefs that an SSB tax would be effective in improving health – "While some studies among the public reported the belief that an SSB tax could improve population health [n = 5], others indicated that such a policy does not cure anything [n = 3]."	"Pooled proportions indicated that of the public . . . 40% (0.29–0.54) believed that an SSBs tax has impact on health-related outcomes", WHILE "92% (0.91–0.93) believed that obesity is a problem"	Beliefs that taxes would be unfair for certain groups – "SSB tax [perceived] as unfair to "healthy" individuals who consume SSBs responsibly"
Niebylski et al 2015[48]	FP (taxes and subsidies) to promote healthy diet	Health-related outcomes	Support for policy action to reduce obesity prevalence – "Improving awareness of the multiple causes of obesity could facilitate acceptance of policy action to reduce obesity prevalence."	–	–
Health equity, equality, and nondiscrimination					
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Socioeconomic inequality	–	"Pooled proportions indicated that of the public . . . 50% (0.48–0.52) believed that an SSBs tax has a negative impact on socioeconomic equality"	Mixed beliefs on the effect of SSB taxation on inequality – "In three studies on political acceptability, an SSBs tax was believed to have a positive impact on equality in health"; HOWEVER, "concerns primarily arose from the belief that an SSB tax is regressive [n = 7]; low-income individuals have to spend relatively more of their income and consume greater quantities of SSBs [n = 2]."

(continued)

Table 3 **Continued**

Reference	Intervention	Subtheme	Narrative synthesis results	Meta-analysis results	Distributional results
Niebylski et al 2015[48]	FP (taxes and subsidies) to promote healthy diet	Helping key groups	–	–	Support for policies to help children – "small taxes with the clear purpose of promoting the health of key groups, eg, children, are more likely to receive public support."
		Tax regressivity	–	–	Beliefs that taxes to reduce SSB consumption would be regressive – "that low SES [groups] may carry more of the fiscal burden . . . may limit feasibility of SSB fiscal policy implementation"
Societal implications					
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Healthy substitutes	Beliefs that a lack of healthy alternatives would lead consumers to consume unhealthy alternatives – "Three studies on public acceptability reported concerns about an increase in the consumption of artificial sweeteners as a result of an SSB tax"	–	–
		Reformulation	Beliefs that an SSB tax would encourage manufacturers to reformulate SSB contents – "UK news website commentators indicated that manufacturers would reduce the amount of sugar as a consequence of the tax, which was viewed as a potential facilitator in the effectiveness of an SSBs tax."	–	–
		SSB prices	Beliefs that tax may not be passed through to consumers – "Studies among Australian citizen jurors and students from Michigan, UK, indicated that a tax rate of 50 to 100% may be large enough to change consumer behaviour."	–	–
Feasibility and health system considerations					
Eykelenboom et al 2019[33]	FP (taxes) on SSBs	Feasibility	Beliefs that SSB taxes could be feasible but many barriers exist – "Examples of barriers are a long law-making process in Mexico and the UK, competing national agendas in Mexico, the difficulty of defining products that should be taxed in Israel and the UK, the difficulty of regulating "home-made, unlabelled products" in Mexico, the development of a black market in Israel, a high administrative load in New Zealand, and political costs of taxation in European countries." AND "resistance from the SSB industry was described to complicate policy adoption and implementation"	–	–

Abbreviations: FPs, fiscal and pricing policies; GDP, gross domestic product; SES, socioeconomic status; SSB, sugar-sweetened beverage.

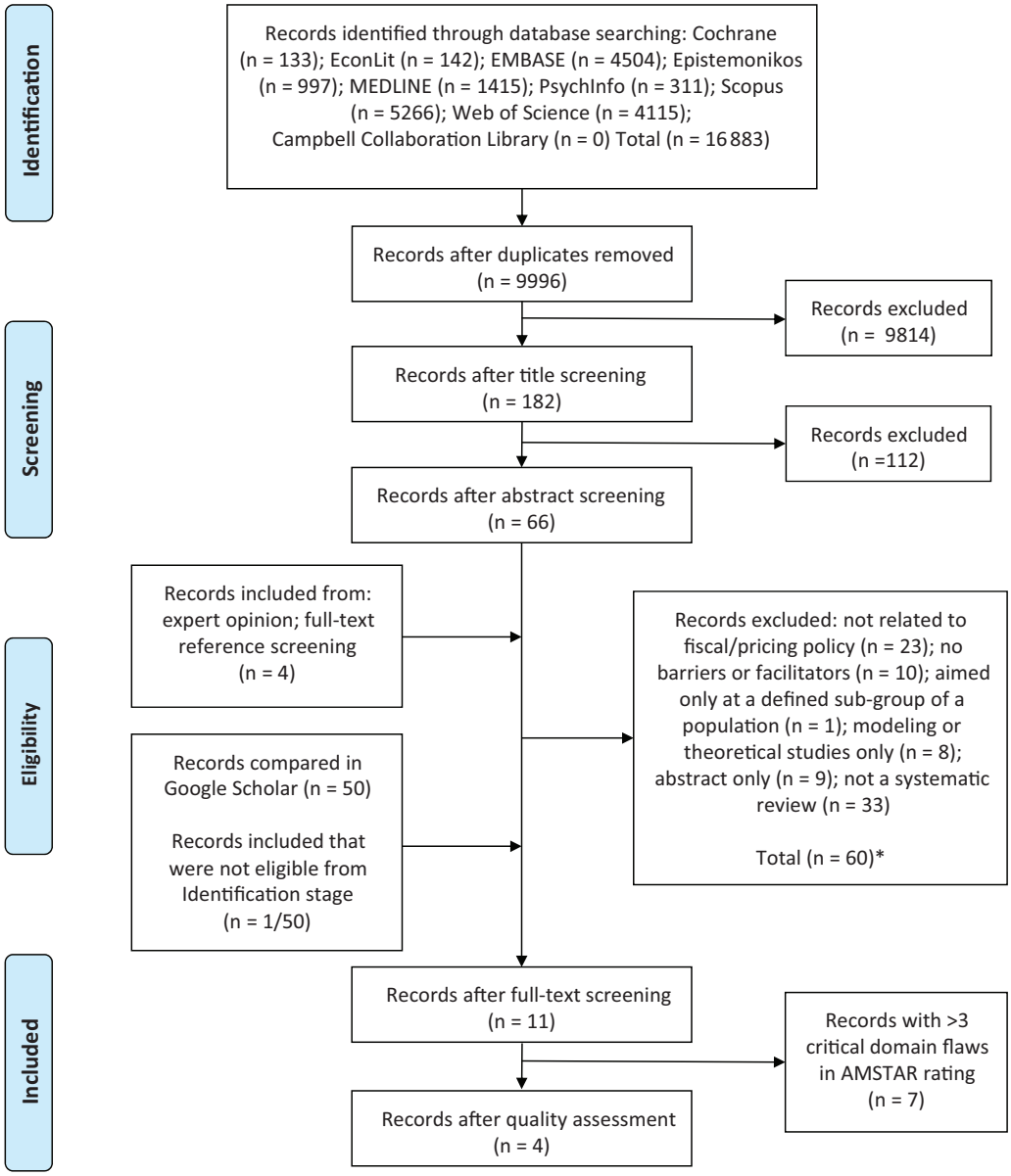

Figure 1 **Flow diagram of the literature search process.** *Counts for individual exclusions do not sum to the total, as reviews may have been excluded based on more than one criterion.

Supporting Information online). Where a review restricted inclusion to studies of humans only, no justification was necessary, and thus no penalty was incurred in the AMSTAR 2 rating. All but 1 of the included reviews[48] reported either no conflicts of interest or, where conflicts of interest were reported, they described how these were managed so as not to influence results (please see item 16 in Table S4 in the Supporting Information online).

Characteristics of included reviews

Table 2 provides an overview of each of the 4 included reviews: Dodd et al (2020),[47] Eykelenboom et al (2019),[33] Mounsey et al (2020),[49] and Niebylski et al (2015).[48] There was little overlap in studies across these reviews. Of the 78 studies included in Niebylski et al (2015),[48] 2 studies[52,53] were also among the 37 studies included in Eykelenboom et al (2019),[33] 2 studies[54,55] were among the 18 in Dodd et al (2020),[47] and 1 study[56] was among the 11 included in Mounsey et al (2020).[49] Three reviews focused solely on taxation, with 1 focusing on SSBs only,[33] another on SSBs and energy-dense foods,[49] and 1 on salt and salty foods.[47] The last review included the use of both taxes and subsidies to promote a healthy diet more generally.[48] The reviews were published between 2015 and 2020. Three of them had search strategies that were restricted to English language

only; none of these provided a justification for this. The types of research design and the populations covered in the reviews varied widely, with 3 reviews including modeling studies.[47–49] One review included qualitative and mixed-methods data that were used to assess real or perceived B/Fs for the public and policy makers globally, alongside quantitative data, as part of a meta-analysis to estimate support for SSB taxation and to identify arguments used to justify support for or opposition to SSB taxation.[33] Two focused on general populations,[47,48] though Niebylski et al (2015) restricted their sample to Western Europe, Canada, the United States, Australia, and New Zealand. One review looked at the macroeconomic impacts of SSB and energy-dense food taxation for the national economies of Brazil, Mexico, South Africa, the United Kingdom and the United States.[49]

Acceptability of fiscal and pricing policies

Financial and economic considerations. Three of the 4 reviews included subthemes relating to "financial and economic considerations."[33,48,49] These subthemes included macroeconomic impacts in general, as well as more specific impacts like those on GDP, government revenue, employment, and industry sales. Eykelenboom et al (2019) examined the beliefs of the public and of policy makers about these economic impacts, finding that both the public and policy makers had concerns that SSB taxation could lead to job losses and business closures, but that they may also provide a means of raising revenue that could be used to support social programs and health initiatives.[33] Though these authors do not define the term "belief," it was found to refer to situations in which there was a subjective assessment of an assertion as to whether it was positive (eg, obesity is a problem) or negative (eg, obesity is not a problem). In a meta-analysis (n = 2) of perceptions regarding their potential to raise revenue for health programs, the authors found that only 39% (95% confidence interval [CI]: .36–.41) of the public believed this would be the case.

Both Niebylski et al (2015) and Mounsey et al (2020) identified empirical evidence that taxes on food and non-alcoholic beverages are likely to be revenue raising[48,49] and support the allocation of revenue towards NCD prevention programs or healthy food subsidies.[48] Mounsey et al (2020) estimated that revenue from SSB taxation would range from US$1.05 to US$43.39 per head of the population in the jurisdiction to which the tax was applied; however, the length of follow-up varied across estimates.[49] Much of this data came from modeling studies that also estimated that industry sales and GDP would be negatively impacted, as would revenue from local sales tax (due to cross-border shopping).[49] Mounsey et al (2020) highlighted the limitations of these estimates as being (i) very dependent on modeling assumptions – which often failed to account for important factors like substitution by consumers – and (ii) mostly industry-funded. They found no evidence, except from industry-funded modeling studies, that diet-related taxes result in net unemployment.[49] The 2 peer-reviewed (and non–industry-funded) studies that used interrupted time series analysis (ie, the result was not simulated) found no net change in either employment or unemployment following the implementation of soft drink and SSB taxes in the United States and Mexico.

Human rights and sociocultural acceptability. Three reviews included subthemes addressing "human rights and sociocultural acceptability."[33,47,48] These related to: the appropriateness of and support for taxation as an intervention strategy; whether food and non-alcoholic beverages, specifically SSBs in this instance, are a good target for FPs; and whether industry and government stakeholders can be trusted as part of the policy-making process. Although some doubt was reported as to whether SSBs contribute to obesity, there was a general consensus that they do, with Eykelenboom et al (2019) finding that, across 5 studies from the United States, the United Kingdom, and Mexico, 68% (95% CI .48–.85) of the public believed SSBs were an appropriate intervention target.[33] There was much less support for taxation as an intervention strategy to reduce the consumption of unhealthy products or nutrients, in particular SSBs and salt.[33,47,48] In a random-effects meta-analysis of studies from the United Kingdom, the United States, Australia, and France, only 42% (95% CI .38–.47; n = 9) of the public supported SSB taxation, and this was similar when it was framed as a strategy for reducing obesity (39% [95% CI .29–.50]; n = 10).[33] Support rose to 66% (95% CI .6–.72; n = 4) where it was indicated that SSB tax revenue would be used "appropriately." (The contextual meaning of this term varied from study to study but generally focused on the use of revenues to fund health initiatives, such as healthy food subsidization.) The difference between these estimates highlights the importance of policy framing, while also suggesting a level of mistrust among the public as to the use of tax revenues currently. This was evidenced further by pooled proportions of beliefs indicating that, across 3 studies in the United Kingdom and the United States, 61% (95% CI .56–.67) of the public mistrusted the government. Mistrust of industry was also reported,[33,47] while support for salt taxation was higher among those who believed that food manufacturers have a responsibility to reduce salt consumption.[47]

Balance of health benefits and harms. Pooling across 2 studies from the United States and Australia, 92% (95% CI 91%–93%) of the responding public believed that obesity was a public health issue,[33] while adults in Great Britain believed that improving awareness of this issue would increase support for policies to tackle obesity.[48] While there were reports that both policy makers and the public believed that SSB taxes would reduce their consumption and be cost-effective, pooled proportions indicated a degree of scepticism. Across 7 studies from the United Kingdom, the United States, Mexico, and France, 39% (95% CI .26–.54) of the public believed an SSB tax would reduce consumption, and across 5 studies from France, the United Kingdom, and the United States, 40% (95% CI .29–.54) believed it would improve health-related outcomes.[33] In addition to the direct effect of FPs on consumption and health, Eykelenboom et al (2019) noted concerns among the public as to the availability of healthy alternatives where substitution is incentivized. This included, for example, beliefs that an SSB tax could increase consumption of artificial sweeteners, which is discussed further under "Societal implications."

Health equity, equality, and nondiscrimination. Equity was examined both with respect to the distribution of the tax burden and health effects. Distributional issues that relate to the "health equity, equality and non-discrimination" of FPs were raised in 2 reviews.[33,48] Both identified concerns among the public and policy makers that taxes can be regressive, placing a larger burden on those with less income. Eykelenboom et al (2019) found that some policy makers believed that SSB taxation could improve health equity. However, the public seemed less aware of this potential, or at least did not perceive it as a facilitator: concerns were raised as to whether the tax would reduce consumption among those who are not price sensitive (eg, high-income individuals), those addicted to SSBs, and those who have high levels of obesity; and about it being unfair to "healthy" individuals who consumed SSBs responsibly.[33] Results from 2 studies in France and the United Kingdom indicated that 50% (95% CI .48–.52) of the public believed that SSB taxation increased socioeconomic inequality while the same study from the United Kingdom found that only 36% believed it would have a positive effect. Niebylski et al (2015) noted that, while this regressivity may limit the acceptability of taxes, clear promotion of the tax as helping key groups, such as children, could help to counter this.

Societal implications. Subthemes around the availability of healthy alternatives, industry efforts to reformulate foods, and changing prices were grouped under "societal implications." In Mexico, for example, inadequate investment in clean drinking water infrastructure decreased the acceptability of an SSB tax, though the use of revenues to increase clean drinking water accessibility was seen as a facilitator to their continued implementation. In Australia, it was suggested that the price of packaged water should be reduced alongside SSB taxation; in the United Kingdom, on the other hand, people were concerned about an increased consumption of artificial sweeteners.[33] By contrast, both the public and policy makers expressed doubts that an SSB tax would raise prices sufficiently to change behavior, suggesting a perceived lack of vigor in the policy-making process. This perceived lack of vigor was thought to be a result of industry interference; however ,where manufacturers opt to reformulate their products so as to avoid the tax, this was seen as a positive by the public.[33]

Feasibility and health system considerations. A number of barriers were also identified in Eykelenboom et al (2019) as impacting upon "feasibility and health system considerations." Long and complex political and administrative processes with competing views across stakeholders, especially resistance from the SSB industry, were seen as barriers to the implementation of an SSB tax, as was the development of shadow economies, for example home-made goods.[33] While Dodd et al (2020) did not report on studies addressing this criterion, they discussed the added complexities of taxing a nutrient (eg, salt), as opposed to a single product (eg, SSBs), as nutrients are more pervasive across the food supply.[47] This can create a negative cycle whereby evidence for the effectiveness of easier to implement product-based taxes grows and facilitates the further implementation of such taxes. On the other hand, nutrient-based taxes, although potentially more efficient,[57] face the barrier of a lack of RWE, further inhibiting the likelihood of their implementation.

Robustness check

The supplementary literature review identified 31 studies published between January 2020 and November 2021 that examined B/Fs as part of the process of implementing taxes or subsidies on food and non-alcoholic beverages to improve diet and prevent diet-related NCDs (please see Figure S2, Tables S5 and S7 in the Supporting Information online). These covered FPs – implemented or proposed – in Barbados,[58] Botswana,[35,59,60] Chile,[61,62] Colombia,[62] Kenya,[35,59,60] Mexico,[29,61,62] Namibia,[35,59,60,63] the Netherlands,[31,32] Rwanda,[35,59,60,64] South Africa,[28,65–67] Tanzania,[35,59,60]

Uganda,[34,35,59,60] the United Kingdom,[68,69] various jurisdictions within the United States,[70–82] and Zambia.[35,59,60] Two studies examined the feasibility of fruit and vegetable subsidization programs in the United Kingdom[68] and the United States,[75] finding that communities often engaged in these programs and that existing government structures in the United States could facilitate such a program, but a voluntary opt-in approach for local jurisdictions would be more feasible than a mandatory one. One study examined revenues raised from a tax on unhealthy foods within the Navajo Nation, finding an increase in revenues that declined over time.[73] The remaining 28 studies related to taxes on non-alcoholic beverages, namely SSBs. The majority of studies presented evidence that related to "financial and economic considerations" (n = 20), followed by "human rights and sociocultural acceptability" (n = 19), "feasibility and health system considerations" (n = 17), "balance of health benefits and harms" (n = 12), "health equity, equality, and non-discrimination" (n = 8), and "societal implications" (n = 8).

A number of studies examined the political process of implementing FPs (almost entirely SSB taxes), finding that a key barrier to this process related to industry-promoted anti-tax arguments that they lead to economic harm, [28,31,34,35,62,63,67,80,82] such as unemployment or reduced sales revenues: concerns echoed by retailers.[70] Studies which examined the economic impact of SSB taxation, found a lack of RWE that taxes have a negative impact on employment within affected industries and in general,[74,78] or a negative impact on retailers who, in the US, supported implementation of nationwide SSB taxation.[71]

Support for taxation among the public was often low, owing to concerns about its effectiveness, doubts about how equitable it might prove,[32,58,65,70,76,77,82] and mistrust in the government's use of revenues or transparency in the implementation process.[32,65,70,76] Beliefs about the benefit of and support for taxation tended to be lower among those with high consumption of SSBs, those who were overweight, and those who were less educated.[32,76,77] In the case of Eykelenboom et al (2021), these 3 factors were independently associated with acceptability of an SSB tax in the Netherlands.[32] Key facilitators in the implementation process related to how diet-related taxes were framed (as revenue-raising[28,29,31,73] or as health-improving[34,35,63,69]) or related to the allocation of revenues towards social programs (eg, early-childhood education) and health initiatives (eg, healthy food subsidization).[28,32,59,69,72,81,82] Media campaigns were found to be effective in promoting such messages and were seen as a facilitator in the implementation process, alongside strong advocacy and networks among pro-tax stakeholders.[28,29,35,59,61–63,66,80–82]

DISCUSSION

An umbrella review was conducted to assess the highest level systematic review evidence regarding the acceptability of FPs related to food and non-alcoholic beverages and aimed at the improvement of diet and the prevention of diet-related NCDs. Four systematic reviews – 1 including a meta-analysis – were included in the final sample, and while the potential to focus more broadly on FPs was allowed, the majority of evidence related to diet-related taxes, in particular for SSBs.[33,47–49] B/Fs impacting upon acceptability were grouped according to the WHO-INTEGRATE framework criteria for guiding complex public health interventions.[22]

Evidence was found that public and political acceptability is influenced by beliefs about the financial and economic considerations of FPs. While both the public and policy makers believed that taxation would be revenue raising, they were also concerned about the potential for job losses or business closures.[33] Two reviews found evidence that diet-related taxation was revenue-raising,[48,49] with 1 also finding increases in unemployment, and reduced industry sales and GDP.[49] Concerns were raised by the review authors as to reliance on modeling studies and a lack of RWE regarding these impacts.[47–49] Mounsey et al (2020) in particular found that, while all 11 of their included studies showed increased government revenue from diet-related taxation, only the modeling studies that were also funded by industry stakeholders, found reductions in employment.[49] The 3 non–industry-funded studies, including the 2 that used RWE, found no significant reduction in employment. The authors question the influence of industry in the research process. Eykelenboom et al (2019) found that the public and policy makers believed a barrier to implementation of diet-related FPs was industry resistance, with lobbying and relationships between industry actors and politicians being a concern.[33] In meta-analysis, they also found that a majority of the UK and US public mistrusted the government (61% [95% CI: .56–.67]). Facilitators in this regard include a credible evidence base of the potential of FPs to raise revenue and not to adversely affect economic outcomes such as unemployment. Barriers include a lack of trust in government: for example, in the use of revenues raised from diet-related taxation, and a well-organized industry opponent.

Although the public (in the United States and Australia) believed that obesity was an issue,[33] concerns were raised about the use of FPs to tackle this

issue.[33,47,48] These included: doubts about the effectiveness of FPs in changing behavior or improving health; a general lack of support for taxation; beliefs that taxes are regressive or could increase socioeconomic inequality; and a lack of healthy alternatives in the face of diet-related taxes. The majority of the evidence uncovered related to taxes on SSBs. This may be due to: the greater feasibility of taxing a single product (eg, an SSB) rather than a nutrient (eg, sugar); the lack of nutritional value from SSBs (which makes it easier to justify their taxation); and a growing body of evidence regarding the effectiveness of SSB taxes on health and consumption.[47] Why other products (eg, breakfast cereals) do not appear to have been subjected to the same degree of scrutiny is unclear, though it may relate to potential nutritional value. Dodd et al (2020) noted that, even when focusing on salt taxation, most examples relate to taxes on salty products rather than taxes on salt in the food supply. Little evidence was found as to the acceptability of various tax designs, for example, excise vs value-added taxes, or subsidization in general. However, indirect evidence was found that the acceptability of subsidization as support for taxes was highest among the public when revenues were earmarked for health initiatives, such as healthy food subsidies.[33] This may suggest that the public will support initiatives alongside taxation that attempts to counter their perceived potential to exacerbate socioeconomic inequalities. While there was some evidence that policy makers believed SSB taxes would improve health equity, this did not appear to be the case among the public, who were concerned that taxes would be ineffective for those who are overweight or addicted to SSBs, while being unfair to those who consumed them responsibly.[33] Therefore, facilitators include a credible evidence base for the potential for diet to affect health and for the potential for FPs to address this, and a credible evidence base that the FPs do not have harmful regressive properties. Barriers include (i) a lack of trust in government to use the revenue raised to benefit the public, and in particular to benefit those whose taxes pay for these revenues; and (ii) a lack of transparency around the use of funds.

A general limitation of umbrella reviews can be their timeliness. As they are reviews of reviews of primary studies, there is potential for them to lag behind emerging evidence. A supplementary literature review of primary studies published between January 2020 and November 2021, examining the acceptability of taxes or subsidies on food and non-alcoholic beverages as a strategy for improving diet and preventing diet-related NCDs, was therefore conducted. These results support those of the umbrella review, finding that: (1) the majority of studies (>90%) focus on SSB taxation; (2) the policy-making process is inhibited by industry influence and narratives around the negative economic impacts of diet-related tax implementation,[28,31,34,35,62,63,67,80,82] even though the 2 studies using RWE to examine this found no significant impact of an SSB tax on employment[74,78]; (3) the policy-making process is facilitated when diet-related taxes are framed as revenue-raising[28,29,31,73] and when revenues are allocated towards social programs (eg, early-childhood education) and health initiatives (eg, healthy food subsidization).[28,32,59,69,72,81,82] Additionally, support was found for SSB taxation being lower among less-educated individuals, and among those who are overweight or who have high SSB consumption,[32,76,77] and for the policy-making process being influenced by media campaigns and facilitated by strong advocacy and networks among pro-tax stakeholders.[28,29,35,59,61–63,66,80–82]

One systematic review published after the search date also examined B/Fs in the policy process for food environment policies, which included FPs.[83] They also highlighted industry resistance as the key barrier in this process, followed by: a lack of resources; technical challenges as part of the complex policy-making process; a lack of political will; and non–policy-friendly characteristics in those implementing the policy (eg, fear of consumer rejection or interruptions to the business cycle).[83] Facilitators in order of citation frequency were: strategies in the policy implementation process (eg, how a tax or subsidy is framed to the public); resource availability; stakeholder support; an opportunistic policy window; and strong leadership.[83] Another more recent systematic review that excluded modeling studies and simulation studies found no change in employment following the introduction of SSB taxes.[84]

There is growing recognition that, for nutritional policy change to occur, understanding the costs and benefits of an intervention is necessary but not sufficient.[85] Rather, political will, underpinned by public will, is necessary for policy change to occur, and this is in turn influenced by the real or perceived B/Fs associated with that policy. For a policy maker interested in implementing diet-related FPs, 2 recommendations emerge from this review. These highlight the drivers of acceptability, and the issues that warrant careful consideration in order to address public concerns.

Countering misleading anti-tax narratives

Public opinion may sometimes direct government to do something, but more often there is a different dynamic: public opinion restricts government from doing something.[27] In the United States, industry-funded informational campaigns focusing on the negative economic

effects of SSB taxes were successful in blocking municipalities from enacting beverage taxes.[86,87] While negative economic effects were a concern to both the public and policy makers,[33] there was a lack of evidence – except from industry-funded modeling studies – that these concerns were justified. Modeling studies may provide useful evidence as part of the policy-making process. For example, they can model higher tax rates than those actually implemented by governments, given that taxes are usually met with industry opposition.[88] However the contrast noted between the industry-funded modeled results and the non–industry-funded results (which included modeling and RWE) highlights their limitations and the risk of bias.

This was reaffirmed in the supplementary literature review[74,78] and in a number of studies examining the political process of SSB taxation across different jurisdictions, all of which noted that industry narratives and influence were a key barrier to implementation.[28,31,34,35,62,63,67,80,82] Support among the public was higher for salt taxes among those who believed manufacturers bear responsibility for poor diet,[47] while associating anti-SSB-tax messaging with the SSB industry was seen as a facilitator in the implementation process in the United States.[80] Policy makers who seek to implement diet-related taxes should confront false narratives from whatever source and with whatever intent, where evidence exists to contradict them. This may need to include efforts to highlight industry's role and conflicted interests in studies that propagate misleading narratives,[89,90] as well as the narratives from advocacy groups that may lean in the opposite direction.

Providing clear evidence-based pro-tax narratives

It may not be enough to push back on misleading narratives. Rather, a clear rationale for implementing diet-related FPs needs to fill this vacuum. The framing of this rationale may be pivotal in the acceptability of diet-related FPs, while also inoculating the public against potentially misleading anti-tax narratives.[91,92] Eykelenboom et al (2019) found that while 92% of the public believed obesity was a problem and 68% believed SSBs were an appropriate target, less than 40%: supported SSB taxation to reduce obesity; believed it would change consumption or health-related outcomes; or believed that raised revenues would be used to fund social programs.[33] However, they found evidence that both the public and policy makers believed FPs could raise revenues for social and health programs, and support among the public increased to 66% when framing focused on the "appropriate" use of revenues from FPs. That is, taxes are likely to be more acceptable to the public when framed as providing revenues for health initiatives such as healthy food subsidization, rather than emphasizing their effect on obesity (an observation supported elsewhere[15]). In Eykelenboom et al (2019), support for SSB taxation in general (n = 9), or for SSB taxation to tackle obesity (n = 10), or SSB taxation if revenue is used "appropriately" (n = 4) varied across the included studies and countries, as evidenced by their high I^2 statistics (>95%), which measure heterogeneity across study effects. However, only in the case of taxation when revenues are used "appropriately" was support consistently greater than 50%, and this included the fewest studies.

Evidence was found to support the revenue-raising potential of diet-related taxes in this umbrella review,[48,49] and the supplementary literature review uncovered examples of raised revenues being used as intended by government to fund social programs (eg, early-childhood education) and health initiatives (eg, healthy food subsidization).[28,32,59,69,72,81,82] While there is strong evidence that FPs can change the consumption of targeted goods, there is currently a paucity of evidence – except from modeling studies – that they can improve health. This may relate in part to design issues, such as lower tax rates than recommended, or leakage as consumers shop in untaxed jurisdictions or substitute untaxed products for taxed products.[88,93–97] Where untaxed substitutes are also unhealthy, these should be taxed, but caution is warranted where such substitutes also provide micronutrients (eg, fruit juices contain sugar but also vitamins),[57,98] or where there is concern about a lack of access to healthy or safe alternatives.[33] The paucity of RWE as to their health effects creates a negative loop, enabling opponents to use this information to undermine tax implementation (either blocking the implementation altogether or reducing the suggested tax rate of a 15%–25% increase in the price faced by consumers[88,99–101]), further inhibiting the potential to produce RWE. However, other designs may be more acceptable, even as evidence of their effect on health continues to emerge. For example, the United Kingdom and Ireland coordinated in the development of a tiered tax on the excessive sugar content of soft drinks, thus reducing opportunities for substitution with other sugary drinks or soft drinks from untaxed jurisdictions (between Ireland and Northern Ireland), as well as bringing manufacturers to the table and incentivizing them to reduce the sugar content of their products to avoid the tax threshold.[102,103]

Evidence was also found that both the public and policy makers believed SSB taxes to be regressive, though some policy makers acknowledged their potential to reduce health inequalities.[33] Studies elsewhere suggest that they are likely to be minimally regressive and have net positive impacts on socioeconomic

inequality,[16,104,105] though the levels at which they are levied should be considered carefully. In the supplementary literature review, it was found that strong advocacy and clear messaging among pro-tax stakeholders was a key facilitator in the policy-making process.[28,29,35,59,61–63,66,80–82] Policy makers who seek to implement diet-related taxes, who counter misleading narratives regarding their impacts on the economy and inequality, should also promote: the health-harming nature of the targeted nutrient/product; the effectiveness of taxes in changing consumption; their revenue-raising potential; and the earmarking of revenues to fund programs that can further reduce inequality and improve health, especially for children.

Further considerations

While the use of evidence to counteract anti-tax or promote pro-tax narratives is important, a number of other issues arose that can impact on the acceptability of diet-related FPs. The umbrella review highlighted mistrust in governments' use of revenues, or lack of transparency in the implementation or revenue allocation process, as barriers.[32,33,65,70,76] While taxes may reduce consumption of harmful products/nutrients, they also restrict autonomy and will inevitably be met with opposition from some members of the public. Public support for taxation in general is low but increases when funds are earmarked for health initiatives.[15,33] Where taxes are able to change behavior, the revenue stream may be lower, as individuals reduce consumption of the taxed good or producers reformulate to avoid taxation. A lack of clarity as to the primary goal of the FP – revenue generation or behavior/health change – may undermine public confidence in it.[15] Given the importance of trust in government in predicting public health outcomes, for example, as related to COVID-19 preparedness,[106] policy makers need to work hard to justify such a restriction of autonomy by carefully designing policies with clear intentions. For success, this must be implemented alongside a commitment to transparency in the policy-making process, especially when revenues are to be allocated to social and health initiatives, as has been demonstrated in the United States.[72]

Another issue raised was the lack of healthy substitutes available to populations who face increased taxes on unhealthy food or non-alcoholic beverages.[33] This may be even more of an issue where cross-border shopping is possible and can lead to reduced effectiveness of FPs and less local government revenue.[49,107,108] In Mexico, an added-sugar and calorie-dense tax appears so far to have failed to correct negative externalities due to substitution effects,[96] but it has been maintained as the government revenue and the earmarking of revenues for improved drinking water improved its acceptability.[33,109] Policy makers could capitalize on this barrier to increase acceptability of taxes by earmarking revenues for healthy food subsidization, for example, a 10% reduction in the price of fruit and vegetables.[109] This is expected to be more effective in correcting externalities and internalities than taxation alone.[110] Evidence suggests that the public would support healthy food subsidization,[68,111] and that pairing such subsidization alongside the proposed taxation, could even increase public support for the taxation.[33]

Limitations

The limitations in this umbrella review point to directions for future research. The paucity of systematic review evidence as to the acceptability of non-SSB taxes or subsidies that matched the criteria means it is difficult to draw firm conclusions. While the recommendations provided around taxation could be extended to products and nutrients beyond SSBs, there are important differences, like the feasibility of taxing a nutrient that is pervasive across the supply chain vs a single product.[47] Further research is required in order to understand the acceptability of other diet-related FPs, such as taxes on nutrients like sugar or healthy food subsidization – though it was found that acceptability for diet-related taxation was high (66%) when revenues were allocated to initiatives such as healthy food subsidization.

An overarching criterion from the WHO-INTEGRATE criteria is the "quality of evidence."[22] While the included reviews scored the highest in relative terms, they all received a critically low AMSTAR 2 rating (>1 critical domain flaw). The reviews included were still informative, however. While it is possible these criteria were too restrictive, the common critical domain flaws across reviews ([1] not including a list of potentially relevant but excluded studies; [2] not justifying publication restrictions) highlight relatively simple but important measures for researchers seeking to reduce bias and improve the quality of future reviews. The supplementary literature review was undertaken as a high-level summary of studies conducted in the last 2 years to compare against the umbrella review results, and it did not undergo quality appraisal. It is reassuring that the results of the umbrella and literature reviews were similar, but there is still a risk of bias, and further high-quality systematic reviews, for example, Cochrane reviews, are needed to improve certainty in this evidence base.

Finally, when considering a complexity perspective, the setting in which a FP is proposed is likely to vary across populations, economic cycles, and jurisdictions

and to affect both effectiveness and acceptability. Different behaviors or properties may emerge from the proposition or implementation of different diet-related FPs, or similar FPs in different contexts across time and space.[112] As mentioned, the effectiveness of a diet-related tax in 1 jurisdiction may be influenced by substitution arising from cross-border shopping in another, and thus the power of governments to tax unhealthy items is an important contextual consideration. In Mexico – a national jurisdiction – much of the substitution effects from a diet-related tax came from individuals purchasing untaxed unhealthy foods within Mexico,[96] while in smaller subnational jurisdictions such as Philadelphia in the United States, cross-border shopping was an important source of substitution for a similar tax.[113] An important issue remains the specific economic context of the jurisdiction in which the FP is considered. Jurisdictions with greater reliance on the sugar industry may be more vulnerable to the impacts of a tax on sugar or sugar-added products and thus politically more sensitive to measures that target them. This barrier was highlighted in Rwanda – 1 of the main exporters of SSBs in the East Africa region – when considering the introduction of an SSB tax.[64] Finally, the existing policy landscape into which a diet-related FP is introduced is important in the likely acceptability or otherwise of a FP. Interventions such as regulatory bans on the sale or advertising of unhealthy items or changes in packaging and labeling may substitute for or complement the effects of diet-related FPs and can play an important role in how the public may view the FP.[88,114] While general recommendations have been provided based on evidence from multiple jurisdictions, context-specific research is necessary to gauge acceptability depending on the population or jurisdiction being affected.

CONCLUSION

There is currently limited (less than 50%) support among the general population for the use of FPs to change dietary habits. This lack of support is related to a number of factors that include: their perceived potential to be regressive; a lack of transparency/trust around the use of revenues raised; concern that the level at which taxes are pitched may be ineffective; a paucity of evidence around health benefits; concerns about access to substitutes; and concerns about their potential to harm economic outcomes (propagated by industry such as employment). Where these issues have been addressed, public support is greater. These findings underscore the importance of responding to public concerns and putting in place mechanisms to clarify the evidence base on: outcomes; setting taxes at appropriate levels; and using revenues to address inequalities to which they may inadvertently give rise.

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Supporting Information

The following Supporting Information is available through the online version of this article at the publisher's website.

Figure S1 **PROSPERO umbrella review protocol (CRD42021274454)**

Figure S2 **PRISMA flow diagram for identification of primary studies examining the acceptability of taxes or subsidies on food and non-alcoholic beverages in improving diet and preventing diet-related noncommunicable disease (indexed in EMBASE and conducted between Jan 2020 and Nov 2021)**

Table S1 **Search used across data bases according to key themes**

Table S2.A **Search strategy and results used in MEDLINE**

Table S2.B **Search strategy and results used in EMBASE**

Table S2.C **Search strategy and results used in PsychInfo**

Table S2.D **Search strategy and results used in Web of Science, the Science Citation Index and the Social Science Citation Index Expanded**

Table S2.E **Search strategy and results used in Scopus**

Table S2.F **Search strategy and results used in EconLit**

Table S2.H **Search strategy and results used in Epistemonikos**

Table S2.I **Search strategy and results used in the Campbell Collaboration Library**

Table S2.J **Search strategy used in Google Scholar**

Table S3 **Expert Advisory Panel members**

Table S4 **Quality rating using AMSTAR2 checklist (studies with 2 or more critical domain flaws receive a critically low rating)**

Table S5 **EMBASE search strategy for identification of primary studies examining the acceptability of taxes or subsidies on food and non-alcoholic beverages in improving diet and preventing diet-related noncommunicable disease and conducted between Jan 2020 and Nov 2021**

Table S6 **Matrix of data bases searched and which of these indexed the 11 potentially relevant systematic reviews identified following screening**

Table S7 **Literature review results of primary studies examining the acceptability of taxes or subsidies on food and non-alcoholic beverages in improving diet and preventing diet-related noncommunicable disease (indexed in EMBASE and conducted between Jan 2020 and Nov 2021)**

Table S8 **PRISMA 2020 for abstracts checklist**

Table S9 **PRISMA 2020 checklist**

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